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Post Office telecommunications journal

Winter 1978/79 Vol.30 No.4 Price 18p

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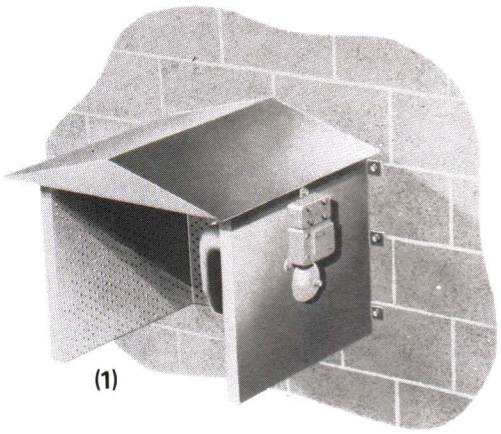

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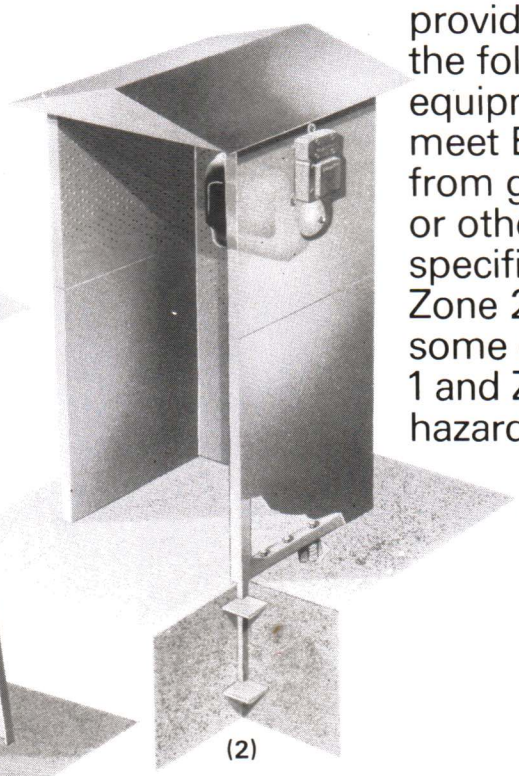

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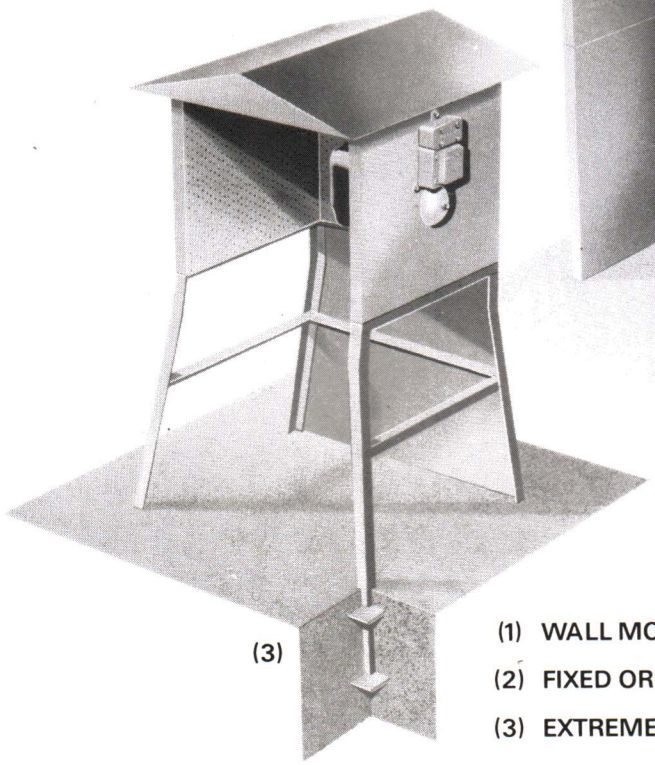

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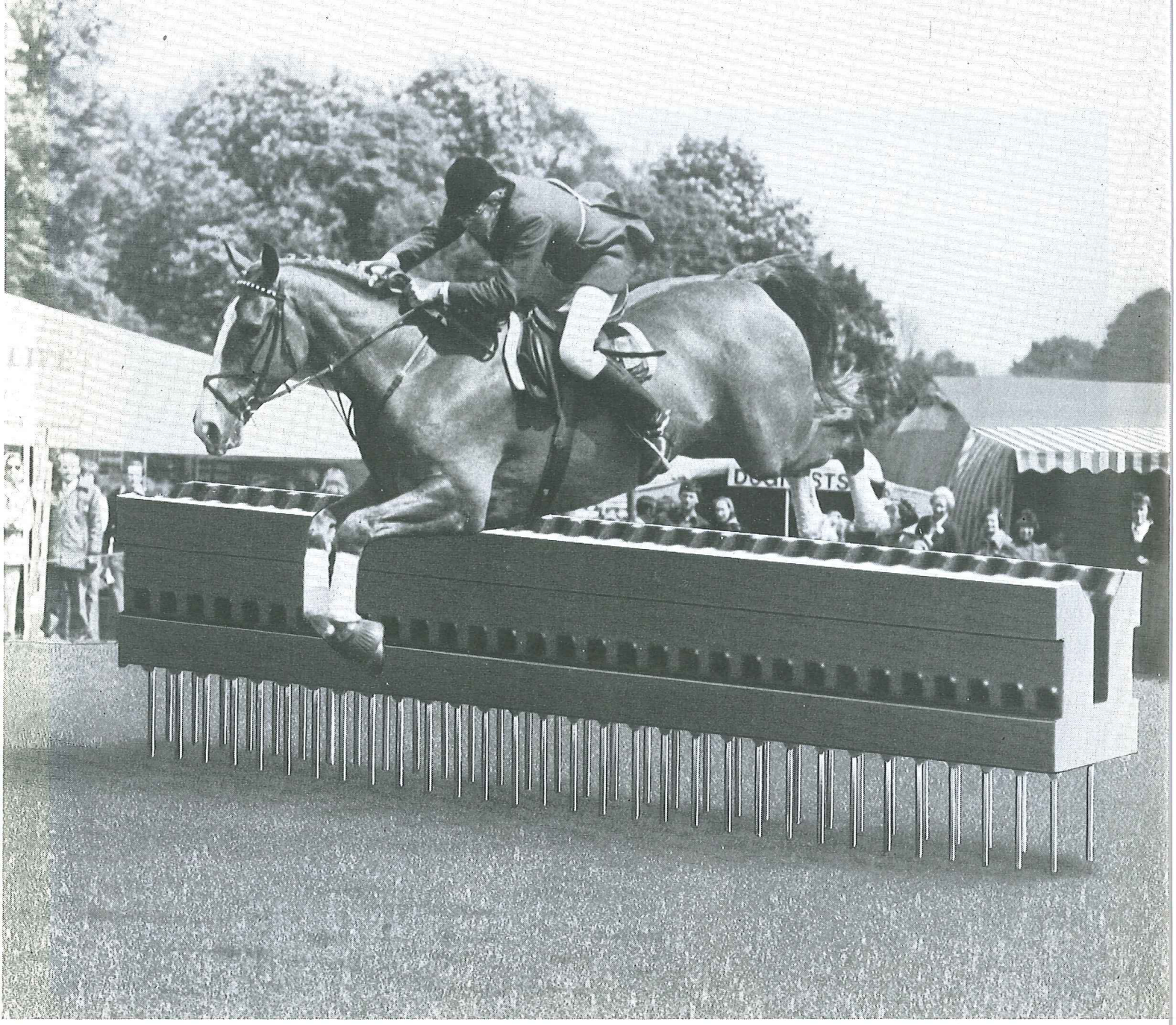

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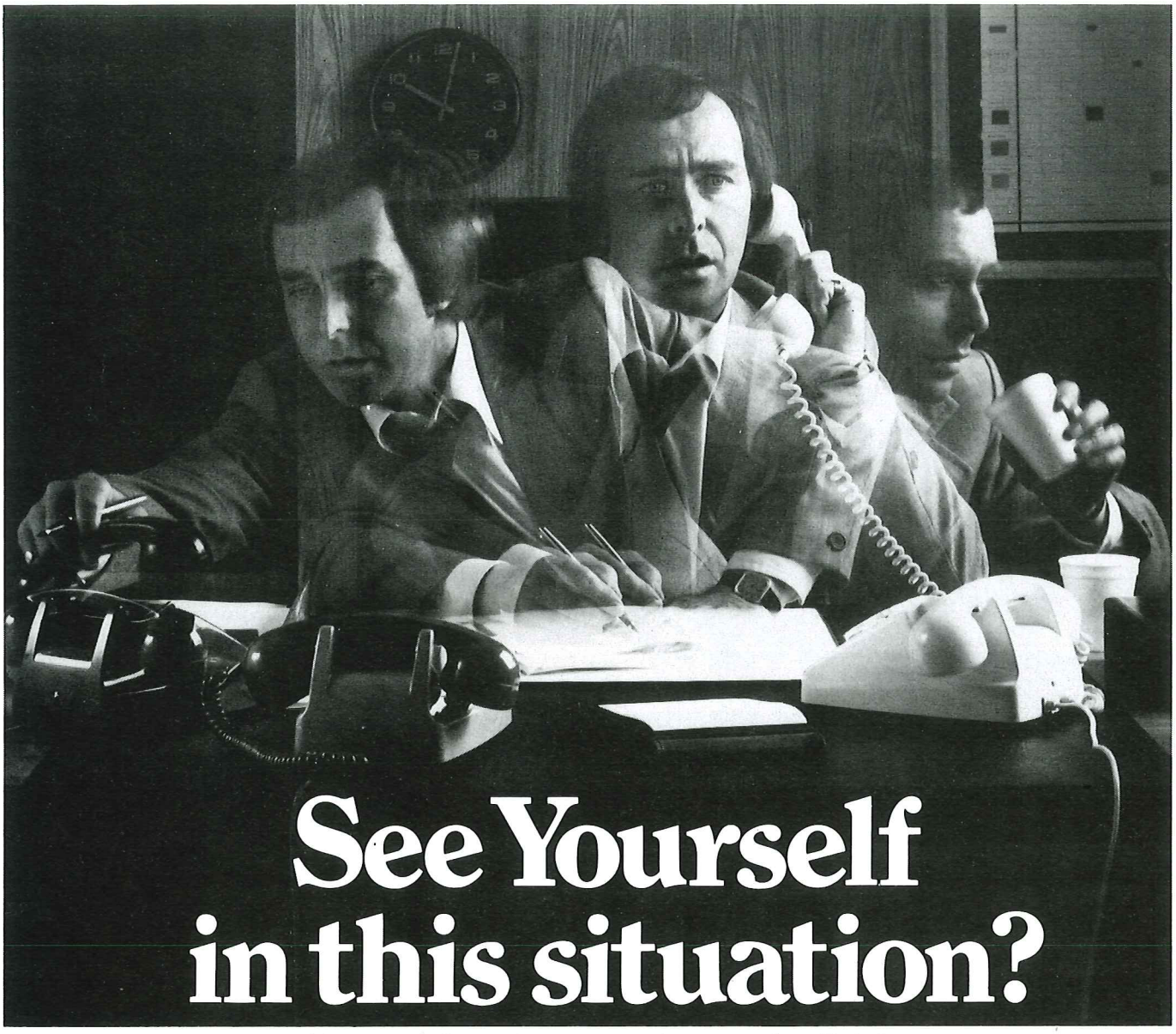

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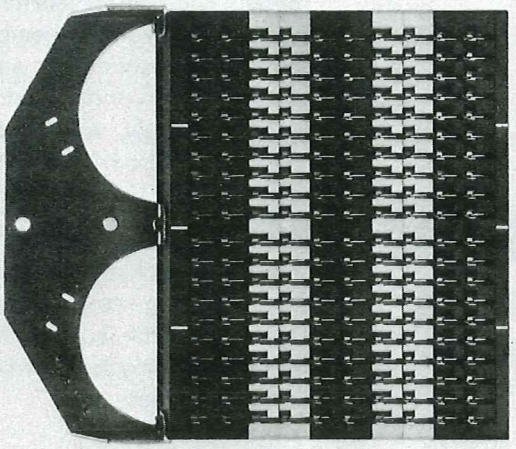
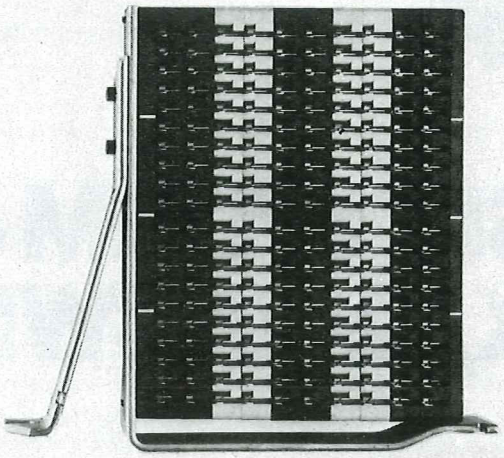


JACK TEST 37/1A



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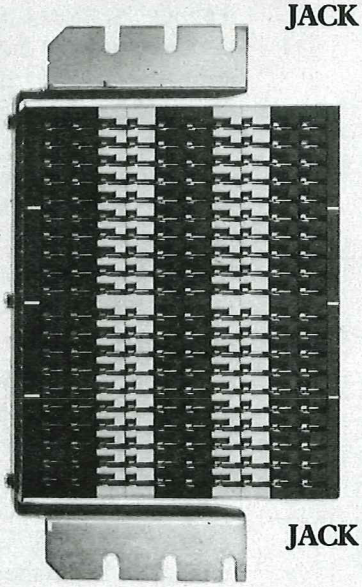

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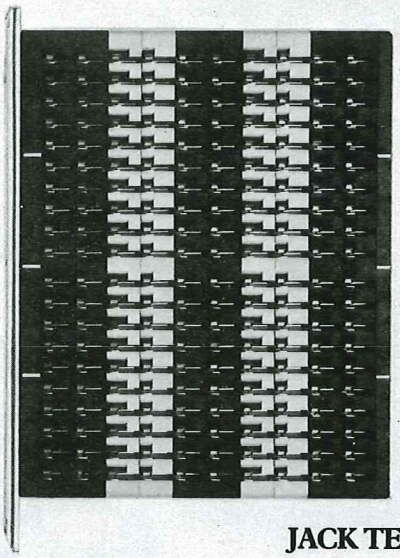

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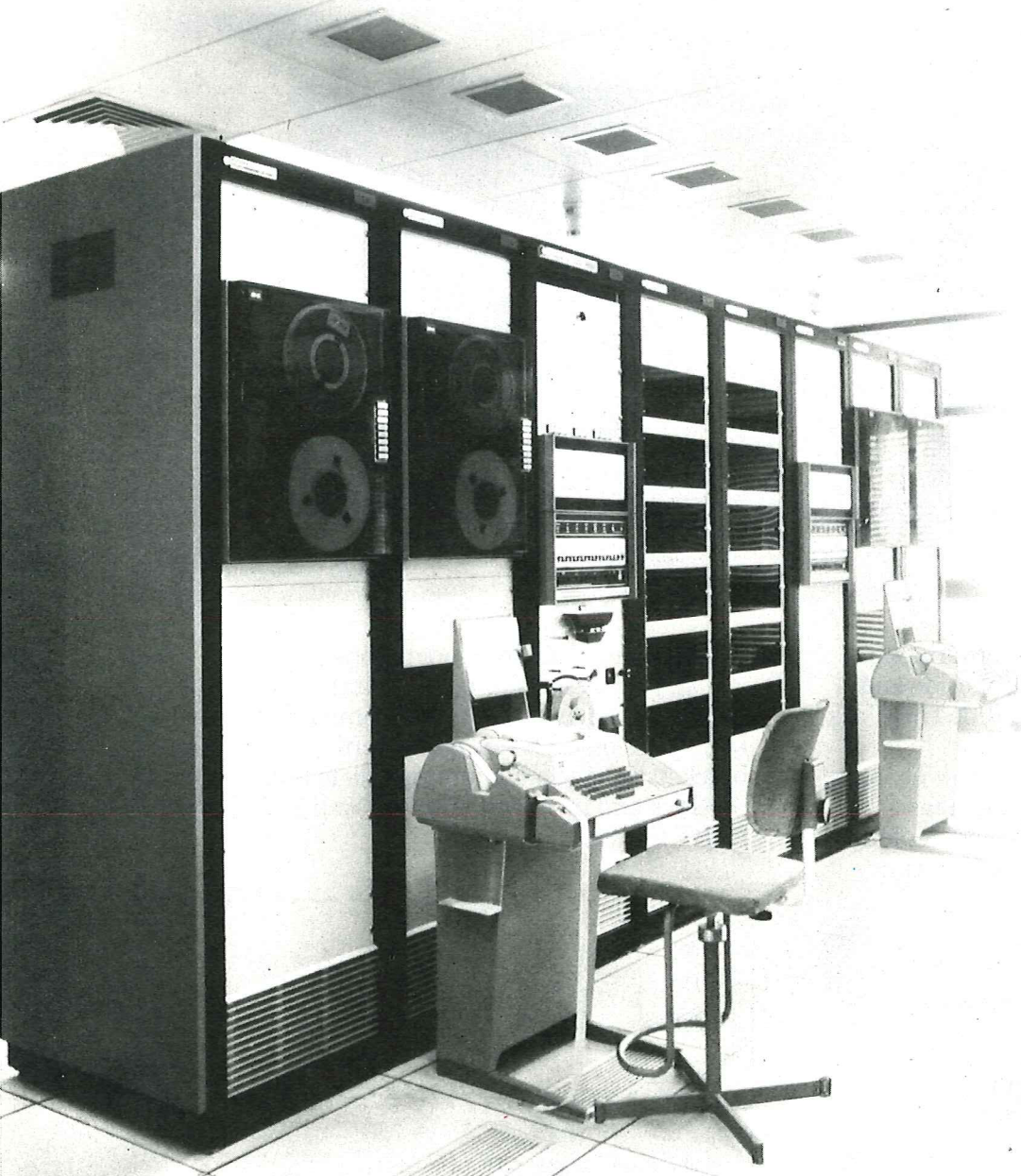

B.P.O. St Botolphs Gateway – London

One of the most advanced SPC telex switching systems available today, System 4660 is also one of the most versatile. Already in service with 8 administrations, in national and international networks, switching telex and low-speed data, System 4660 also caters for a wide range of character-orientated communications equipment operating at between 50 and 300 bauds asynchronously – while synchronous modes can also be handled using optional additional equipment.

VERSATILE
For telex switching, 4660 systems function as line concentrators, Terminal, Trunk Transit or Gateway exchanges, or a combination of one or more of these.

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Provides economic answers to requirements for small to very large exchanges: from a few hundred lines to 32,768 lines (up to 8000 erlangs).
Exchanges can be expanded as traffic increases, economically and without interrupting service, simply by adding more line terminations and processing units.

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All-solid-state switching and storage plus full control redundancy (dual, fully-active computers in each sub-system) and continuous performance monitoring ensure a high order of reliability. Calls or data cannot be lost in the event of equipment failure.
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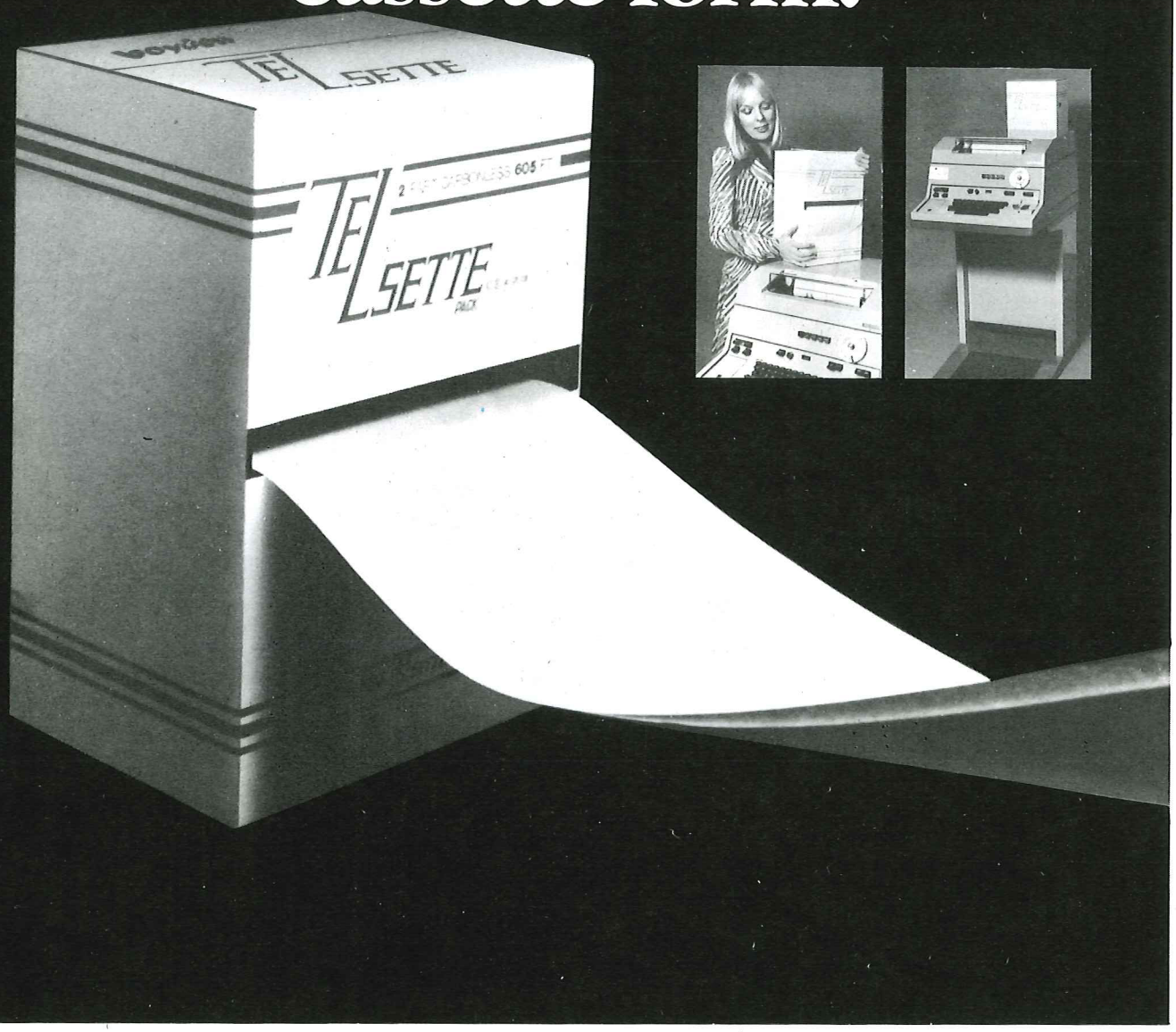

Telsette is a completely new pre-packaged 'cassette' concept in telex stationery.

It gives you 605ft. of high quality Boyden carbonless roll that lasts six times as long as $3\frac{1}{2}''$ two ply roll, eight times as long as 3 ply.

Telsette is simple to fit and ready collated, Telsette feeds straight into your Telex. No clogging or jamming, with a saving of up to 80% end of roll wastage.

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The widest choice of rolls and tapes from a single source.

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When you say that the telephone system revolves round us, you've put your finger on it.

EMI

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A major supplier of telephone dials to the British Post Office

The world of autotelex- by computer

The bringing into service of Britain's first computer controlled telex exchange to handle autotelex calls between the UK and more than 100 other countries, marks yet another major development in the Post Office's commitment to strengthening its worldwide communications.

This new exchange in London is a gateway for telex calls into and out of the UK and follows two earlier gateway exchanges which operate using step-by-step electromechanical systems. Already the new electronic system is proving so successful that the Post Office is ordering a second from the supplier – Plessey Controls Ltd.

Together the three gateway exchanges currently provide Britain's 76,000 telex users with access to about one million teleprinters in 205 countries. Autotelex – direct automatic access – is now available to telex users in 120 countries and 98 per cent of all international telex calls are set up by customers without help from an international telex operator.

The new all electronic exchange could eventually provide more than 7,000 extra connections to Europe and beyond to keep pace with the massive growth of telex calls into and out of Britain. At present these calls are growing at about 10 per cent a year to Europe and 15 per cent to other parts of the world.

With its stored program control (SPC), the new unit will also be able to offer extra benefits to Britain's telex users such as automatic multi-addressing and re-try facilities.

The unit maintains a continuous record of information on calls it handles for accounting purposes and traffic analysis. At regular intervals, it produces figures of calls handled and other statistics to provide a check of exchange performance. It also keeps a continuous check on its operation to provide immediate indication of fault detection.

The second exchange which the Post Office is now buying will give a further 37 per cent increase to Britain's overseas telex switching capacity. It will also enable us to make a start on phasing out electromechanical exchanges. The aim is to provide SPC switching for all international telex calls and so to ensure that we remain very much to the fore in this vital area of international communications.

Post Office telecommunications journal

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Switching for the IBA **page 2**

New look for public phones **page 5**

Space measures underway **page 8**

In the desert sun . . . **page 11**

Better way to spread the word **page 14**

Hull's special network **page 16**

Goodbye, TAT 1 **page 19**

In a man's world **page 20**

The quality of service **page 22**

Dialling the radio **page 25**

Competitions by phone **page 27**

Memories on Man **page 28**

Students' package deal **page 29**

Extension for LACES **page 32**

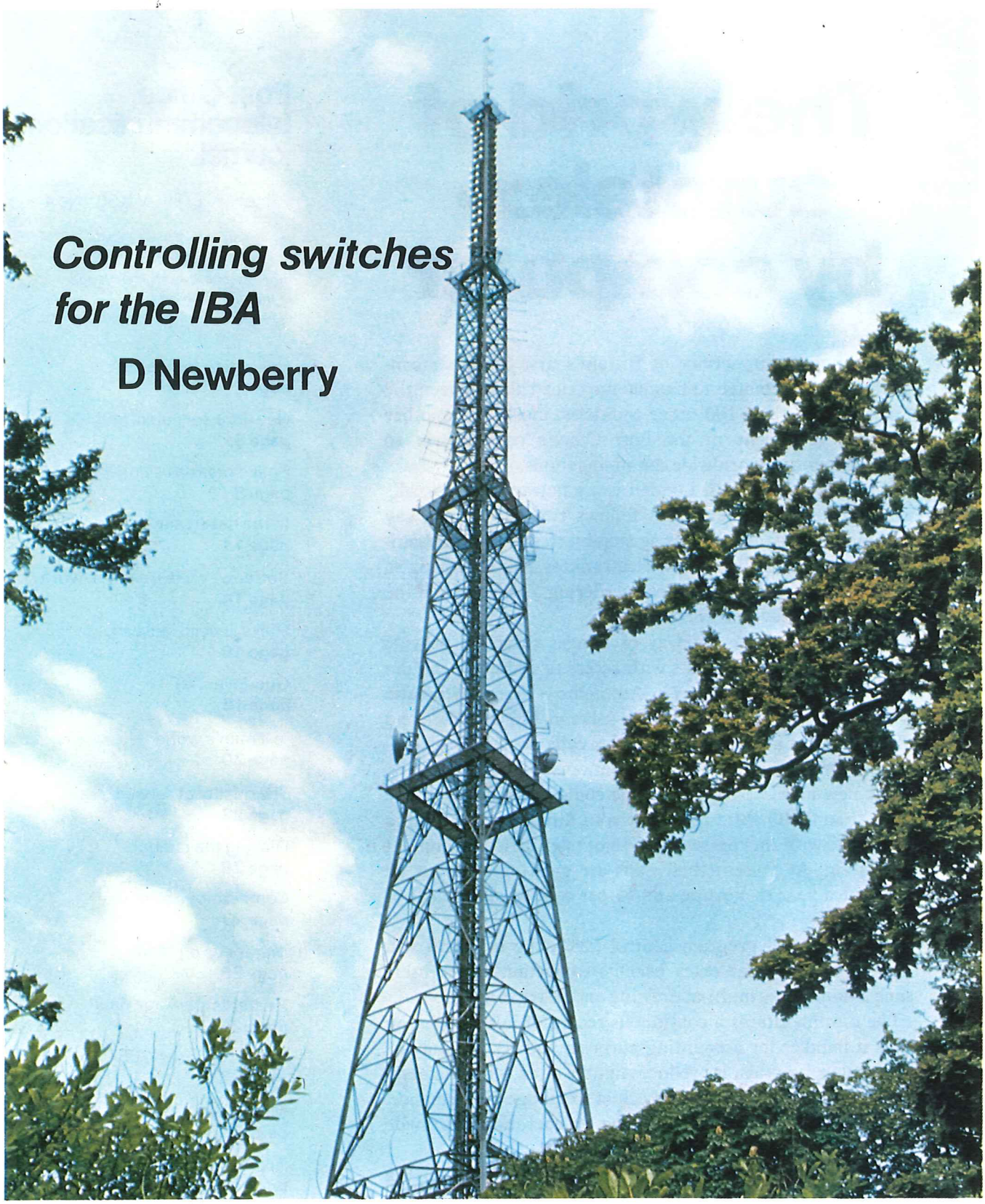
Miscellany **page 35**

Annual index **page 39**

Cover: Hull Telephone Department engineer Tony Bone at work in the local docks testing a telephone cable. When ships berth they 'plug' into the telephone network by means of a special dockside connector. (See page 16.)

Controlling switches for the IBA

D Newberry



The IBA's Croydon transmitter.

AS MILLIONS of viewers settle back each evening to watch television programmes like Coronation Street, Crossroads, and other popular offerings from the Independent Broadcasting Authority (IBA), Post Office staff at network switching centres (NSCs) up and down the country are busy making sure that what appears on the screen is in line with the schedules of the programme companies.

The NSCs are, of course, the vital control points in the national network of vision and sound links which the Post Office provides for both the IBA and the BBC. These links interconnect the broadcasting authorities' own programme switching centres (PSCs), studios, monitor centres and transmitters. Fifteen NSCs are currently operating in the main population centres where broadcasters' and other customers' studios and other premises are located.

The NSCs do not perform switching for the BBC as the BBC1 and BBC2 networks are static and programmes

come mainly from London. Any switching for local news etc. is usually done by the BBC itself at its own switching centres. The independent television programmes, however, are transmitted over the IBA network of links which are switched by Post Office staff at the NSCs in accordance with the requirements of the programme companies.

The switching of the links is co-ordinated by the IBA at their lines booking office. A daily schedule of switching and the connections to be made are normally sent out a week in advance of programmes to nine of the NSCs where switching is frequent and random. The remaining NSCs, where switching is infrequent and at regular times throughout the week, hold a permanent schedule.

Amendments to the scheduled switching patterns – often caused by late programme changes – are received regularly from the booking office and half an hour is allowed as the minimum notice. A large number of amendments are accepted, however, within a tighter timescale depending on the NSC workload at the time.

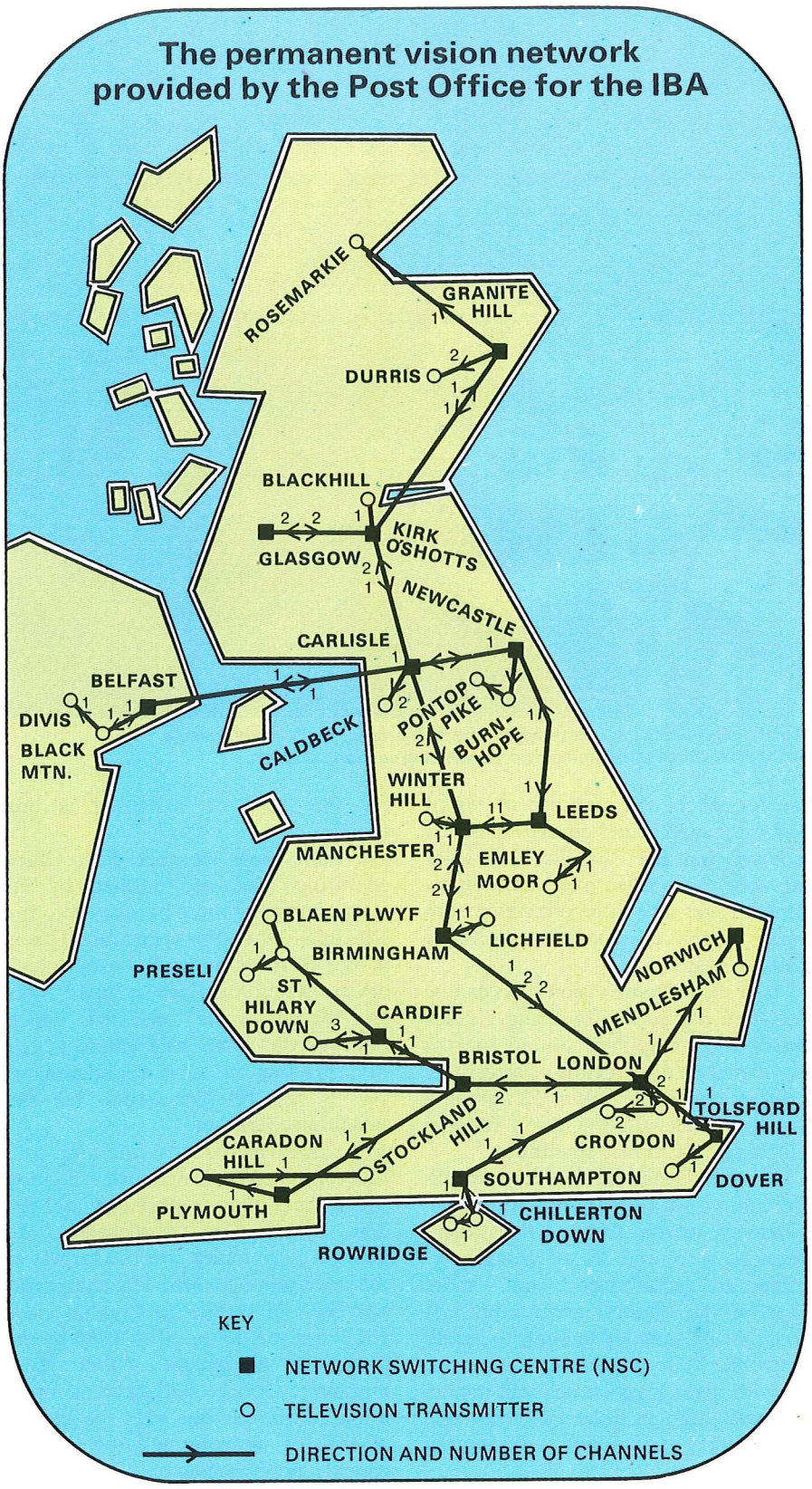
Links can be switched to enable the programme companies to pass information to each other or allow them to transmit locally only and/or nationally. The NSCs, for example, connect the links that enable viewers to see the main news from ITN (London) followed by a local news programme produced by the company covering their particular region. Later they might see Crossroads from ATV (Birmingham), Coronation Street from Granada TV (Manchester), and then perhaps a documentary from Scottish TV (Glasgow), as well as programmes from other companies.

The programme companies have their own switching equipment in their programme switching centres and using this they switch incoming programmes, or their own programmes, to the local IBA transmitter. They can also switch their programmes to the outgoing network link and can use the equipment for internal purposes, such as connecting studios, where programmes are being made, to video tape recorders, which may be housed in a different part of the building.

Between programmes and at allotted times during programmes, advertisements are shown. These may be sent out by the company using the network at the time or alternatively other companies may switch from the network to show their own commercials locally. It is during this period that Post Office staff at the NSCs rearrange link connections to conform with the next pattern required.

Basically, Post Office switching equipment provides for the interconnection of incoming and outgoing links so that any source or incoming link can be connected to any destination or outgoing link. An outgoing link, however, can only be connected to one incoming link at any given time: the equipment is also designed to ensure that transmission suffers minimal distortion.

There are three ways in which the switching operation is performed. The first method is by manual patching which is done in all NSCs and is the main switching facility in seven small



Technical Officers Paul McLoughlin and Bob Bruce at work at the console in the Post Office television network switching centre in London.

centres where the number of vision and associated sound circuits switched is fewer than five each day. Links are terminated on video and audio distribution racks and interconnections are made either by coaxial U-links or patching cords.

Up to six outgoing vision links can be fed from one source by using a video distribution amplifier. Sound sources are distributed by means of a resistive splitter which feeds up to 12 outgoing circuits. Time allowed for a manual patching operation is 10 minutes.

The second method uses key switching and vision distribution amplifiers. These are used at the four NSCs where between three and 10 switching operations are required each day – more than at the smallest centres but not frequent or complex enough to justify providing fully automatic equipment. As with manual patching, both incoming and outgoing links are terminated on vision and sound distribution racks.

For vision, incoming circuits are permanently connected by U-links to distribution amplifiers and for sound, incoming circuits are permanently connected by U-links to resistive splitters. Switching is effected by manual operation of one or more keys. These select the appropriate outputs from the amplifiers and splitters and connect them to the outgoing circuits on the distribution racks. Time allowed for this type of switching is one minute.

In both these methods Post Office operating staff are notified by an alarm normally three minutes before a scheduled switching operation. This is in the form of an audio-visual clock device. When the alarm is heard a key on the clock is operated which removes the alarm and connects TIM (the speaking clock) to a loudspeaker. TIM is the reference time for the switching operation.

The third method of switching uses Marconi automatic network switching equipment. This is provided at London, Birmingham, Manchester and Carlisle NSCs which are the largest in the television network. The equipment has been in service in London since 1967 and was followed in 1968 by the provincial equipment. Other semi-automatic devices had been in operation before this but with the growth of the IBA network and the need to provide programmes on 625 lines for colour transmissions, a contract to Post Office specification was placed for fully automatic equipment.

Incoming and outgoing links are connected automatically at pre-set times after first being programmed by an operator. In London the equipment provides for 30 sources and 40 destinations while at the other three centres there is provision for 15 of each. The time allowed for this type of switching is 10 seconds except for the Friday night change-over in London between the Thames and London Weekend Television companies. On this occasion the feeds to the Croydon transmitter are switched over almost instantaneously, and on odd occasions viewers may detect a frame roll.

The equipment is in four basic parts. The control panel and the visual display panel are in the television control room, while the clock unit and the switching equipment are housed in the television repeater station. The control panel is mounted in a console and has two modes of operation – monitor or operate. In the operate mode the console controls are energised, thus allowing the operator to program the equipment for source to destination connections and their timing. In this mode, control of switching operations can also be effected under manual control if necessary. The monitor mode enables monitoring at the console for sound and vision on all sources and destinations.

The visual display panel is mounted in front of the console. It gives an alphanumeric display of all patterns programmed into the equipment. Each destination has three displays each showing the sources, represented by two-digit numbers, which are and will be connected to that destination in the next two switching operations. As each switch occurs the information moves up one stage – "Next Event" to "On Air", "Store" to "Next Event" and the "Store" display is extinguished ready for the operator to program a new event.

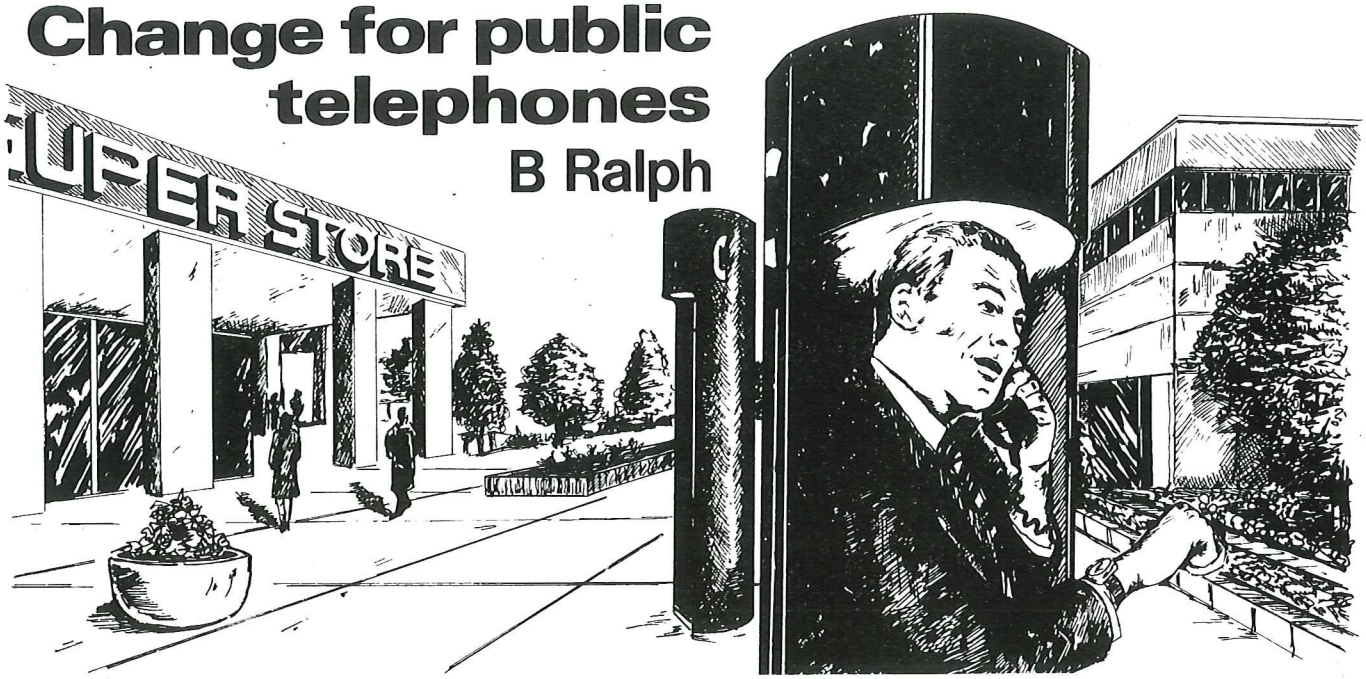
The switching equipment is made up of electronic transmission path and electro-mechanical control and storage equipment. The latter uses motor uniselectors because of their high rate of search – 200 steps a second.

Operation of this equipment calls for the ability to translate switching requirements into the minimum number of switching operations. In the four years ending December 1977 a total of 151,154 switches had been made of which only 0.032 per cent were subject to mis-operations due to human error. This reflects a very high degree of operational efficiency to which, almost certainly, the average viewer never even gives a second thought. . .

Mr D. Newberry is an Assistant Executive Engineer in Service Department's Network Maintenance Division involved in the management of the inland television network.

Change for public telephones

B Ralph



New public telephones controlled by microprocessors and incorporating sophisticated payment systems using coins or debit cards are currently being examined by the Post Office together with new housings as possible replacements for the red, cast iron kiosks which for so many years have been a familiar part of the British landscape.

WITH THE increasing penetration of telephones, especially in the residential sector, in the past 20 years, there has been the feeling in some quarters that payphones – those which permit "pay-as-you-go" calls – would decline. In fact, the way in which people use payphones is changing as penetration increases, and there is little doubt they will be needed far into the future.

In the main people are peripatetic and take their ability to make telephone calls with them as they travel from home to office, away on business, or on holiday. At present, however, only a few people with radiophone facilities can actually take their telephone equipment with them and for the rest, 77,000 public call offices and 300,000 renters' payphones in this country must suffice. And there are, of course still 40 per cent of households without their own telephones.

The situation has now been reached where the way in which the Post Office meets the need for making calls away from home or office is less than ideal. Since the introduction of Subscriber Trunk Dialling (STD), when the timing of local calls first became necessary, the Post Office has been installing the Pay On Answer (POA) system which meets this requirement by timing local calls and measuring coin input from the telephone by means of the coin and fee check relay set in the exchange.

This whole system, however, suffers from a variety of defects. The mechanical coin validation is unreliable, the electro-mechanical coin signalling can sometimes fail, and there is the inability to use more than a single coin as a minimum fee. There could not, for example, be a 4p minimum fee using a POA telephone which of course, has serious implications for the coin telephone tariff structure.

In the system also there has to be complex electro-mechanical coin and fee checking, and there is the need to segregate coin telephone access to international tariff equipment. Added to this there is an inability to cope with metering rates faster than one per four seconds. This means international dialled access is severely limited. Finally, there is difficulty in maintaining the equipment because the system, split between telephone and exchange, makes it difficult to isolate a fault quickly.

There is, too, the question of the public call offices themselves which in the main are kiosks of old-fashioned design. They are cast in iron and are costly to store, install and maintain, as well as being badly ventilated and inconvenient to clean. There is also the fact that the doors require a 12 lb pull to open and some users even have difficulty in determining where the door is in the first place! Added to that they are inaccessible to wheelchair users.

And there is another drawback – the dated image. The older kiosks with their multiple window panes may evoke delighted responses from American tourists, but it is highly unlikely that the Post Office is content to be thought of as merely "cute".

Other European countries have responded in various ways to the need to provide "away from home" telephone facilities. Most have updated their equipment once, and some twice, in the 20 years since POA was introduced and most now have modern, and more convenient housings. Basically there are two main avenues of approach that can be used, singly or combined, to update the present system of POA coin telephones in this country, and provide the earliest and most economical replacements.

The first approach is the modern coin telephone. This is in use in Germany and Switzerland and its main feature is a microprocessor, or at all

events, electronic control which allows important new facilities.

Coin and fee checking, for instance, can take place in the telephone without the need for complex signalling to and from the exchange. This means not only that the minimum fee can consist of several coins, giving maximum tariff flexibility but also that the coin telephone can present itself to the exchange in exactly the same way as a direct exchange line does, and use the same International Tariff equipment.

This allows dialled access to the same range of countries as can be dialled from a private phone in the same location. Coin validation depends not simply, as in the case of POA, on measuring the thickness and rolling diameter of the coin, but on an electronically monitored measure of weight, size, thickness and materials.

Some microprocessor-controlled coin telephones can take any range of coins depending on economic considerations. Some can hold coins inserted in store, cashing them as the call progresses and refunding unused coins in such a way that the largest possible value of unused coins is returned to the customer. Alternatively the user has the option of using this credit to make a follow-on call. Meanwhile, a lighted credit display provides him with information on how much his call is costing him and a warning when his credit expires.

It is, in fact, planned to run a trial with 100 coin telephones incorporating these facilities later this year. They will be introduced at sites with high revenue potential such as international airports and main line railway stations. They will probably take 2p, 10p and 50p coins and will offer all those facilities already described.

An example of a microprocessor controlled coin telephone in use in Switzerland.

The coin telephone used for the trial, a modified version of the type shown (below, left) will be produced as a co-operative effort between a British and a Swiss manufacturer and will, it is hoped, prove suitable for those sites which need full international facilities most urgently. Care will be taken to ensure that the mode of use and facilities are aligned as closely as possible with what continental users now find in their own countries.

The Post Office, meanwhile, hopes to develop its own coin telephone, designed specifically for use at less protected public call office sites and therefore would be as vandal-resistant as possible. It would also be available, possibly modified, for renters.

Another objective of a home-grown version is cost reduction. It would be beneficial to be able to take advantage of recent changes in technology while introducing those economies attendant upon a design specifically produced for the needs of the British system. As a result Telecommunications Marketing Department are currently developing plans for the lower end of the renters' market, which includes actively pursuing the design of a renters' portable coin telephone probably with limited facilities.

The second approach to providing "pay-as-you-go" access is the debit card phone. Recent market research has revealed a reasonable degree of interest in this service and for the Post Office the idea has many advantages. The system works by means of a prepurchased, machine-readable card which is inserted in the "cardphone". The equipment cancels the credit shown on the card as it is used up on a call, the remaining credit being shown to the user by means of a display as with a modern coin telephone.

The card can be either magnetically or holographically coded or can carry its own integrated circuit for fee-reading purposes. The advantage of the latter types is that they are difficult to fake, whereas fraud is relatively easy if traditional magnetic coding methods are used. New magnetic systems are being developed, however, which are fraud resistant. Countries which have tried, or are trying, debit card systems include Italy, Belgium and France.

Advantages to the public of such a system are that there is no need to have change for a call, there is no inconvenience caused by the need to insert more coins during a call, and there is no temptation to would-be thieves to defraud payphone users, as there is no money to be stolen. There is also less likelihood of finding the telephone out of order, as the equipment requires less maintenance. It is also easier to make international calls.

Currently the Post Office is looking carefully at the best ways of selling debit cards so that they are readily available when needed by the public. The value range of cards would need to be chosen with due regard to the needs of particular users. A housewife, for instance might not wish to spend £10 on a debit card, but a member of a major sales force is likely to find this value very convenient.

Advantages of the system to the Post Office – many of which would indirectly benefit the public by keeping down costs – include possibly lower

A selection of telephone kiosks and booths developed in Europe and North America which have been studied by the Post Office. They are from the United States, Canada, West Germany, France and Sweden.

capital cost because coin validation and coin manipulation are expensive to provide, lower maintenance costs, because there is less to go wrong with a debit card phone than with a coin telephone, and there are no coins to collect and count. There is also less likelihood of vandalism and theft as there is no cash container to attack.

But probably the most important fact about debit card phones is that, although further development is still required, they should be available sooner than the POA replacement coin telephone. There is no need to devote heavy development resources to providing them and it is likely they will play an important stategic role in the re-equipment of the payphone service.

Finally, let us consider in more detail the housings for this new equipment. In noisy and exposed urban, and some rural locations there is a need for a fully enclosed structure providing greater acoustic protection than the current familiar kiosks can give. In shopping precincts a modern-looking booth is required, probably with walls not reaching the floor to avoid cleaning problems, and without a door. They must meet the needs of the town planners and architects designing today's shopping environments.

There is need, too, for a structure, probably a pedestal, of the type used in the recent experiment at St Paul's and Charing Cross Road, London, for concourses and acoustically protected locations, as well as one suitable for the physically handicapped. And not least, there has to be a robust, simple structure offering minimum opportunity for damage, in vandal-prone locations.

Various methods of meeting these needs have been examined, and it is hoped to test some structures from other countries with a view to adopting one or more of their range. Current thoughts on design favour a series of structures dependent on a strong column rather than on the shell itself. It is hoped, for instance, to test two models from a firm which produces housings for Bell, Canada, both of which follow this principle. One of the structures is a transparent cylindrical booth, hanging from a disc attached to a column by means of a rigid arm.

In the other model, the telephone is actually inset in the column itself. As well as offering vandal-resistance, this model might also prove suitable for indoor locations requiring a minimum of acoustic protection. Designs from Italy and France are also under review.

The pedestals tried out at St Paul's and Charing Cross Road have since been moved to a vandal-prone site in Surrey, where so far they have remained intact and there has even been an increase in takings over the same period last year. Such is the power of modern design!

The changes envisaged will not be immediate. This is a reflection not of the degree of urgency with which the need for change is regarded, but of the difficulty of bringing the development and production capabilities required to bear on such a large problem. The Post Office and users alike can, however, rest assured that the changes will be effected as soon as possible.

Mrs B. Ralph is a Head of Group in THQ Service Department concerned with the formulation of policy on all aspects of the public call office and telephone credit card services.

PO Telecommunications Journal, Winter 1978/79

Down-to-earth measures for space communication

R G Blake

Nigel Gollin, AEE, makes an adjustment to the radar antenna mounted on the 6.1 m Cassegrain aerial at Martlesham

THE SUCCESSFUL launch of the second Orbital Test Satellite (OTS 2) last Spring by the European Space Agency (ESA), has opened the way for the Post Office to begin a comprehensive series of slant path propagation measurements in the 11 and 14 GHz frequency bands from its Research Centre at Martlesham Heath, Suffolk. The measurements are designed to help with the specification of future microwave transmission earth stations to operate in conjunction with the proposed European Communications Satellites (ECS) due to be launched in the mid 1980s.

The Post Office is, in fact, one of many European organisations which have embarked upon a wide ranging series of tests and experiments with OTS 2 and in addition to using the 6.1m Cassegrain aerial at Martlesham for propagation measurements, it is also making transmission tests at Goonhilly earth station (see Telecommunications Journal, Winter 1976–77).

Until now UK system planners have only had access to propagation data at 11 and 14 GHz collected by sky noise radiometers which measure atmosphere 'emissions'. With the launch of OTS 2 and in addition to using the opportunity to collect direct propagation information using a satellite as well as calibrating 11 and 14 GHz radiometers accurately.

In planning advanced systems using the 11 and 14 GHz frequency bands as in ECS, detailed consideration of various propagation factors was of major importance. The problem of the effect of heavy rainstorms, for instance, had to be examined and the fact that ECS is to be a digital system means the planner needs information on short duration propagation effects – those of less than a second or so – to be able to assess reliability as well as availability of the system.

And as ECS will use linearly polarised transmissions at right angles to each other – known as orthogonal – (see Telecommunications Journal, Summer 1978) information is required on the extent to which rain and ice can cause depolarisation. Theoretical models suggest that linearly polarised transmissions should give as good, if not better, polarisation discrimination and less attenuation than circular.

In preparation for the experiments, which began in January and will last for a year, several in-house equipment developments were made. These included a complex combined aerial feed for simultaneous reception of both linear and circular orthogonal signals at 11GHz while permitting transmission of two orthogonal circular signals at 14 GHz.

And as well as assembling transmitters and other microwave hardware, much attention was given to accurate satellite tracking by the aerial which is driven from a paper tape tracking system. The tape is produced by a computer program which derives predicted pointing angles for Martlesham from the satellite control centre.

With occasional manual control required following satellite man-

oeuvres, a pointing accuracy of ± 0.01° in both azimuth and elevation can be maintained. OTS 2 is positioned at longitude 10°E and from Martlesham the slant path is at approximately 30° elevation.

A pair of orthogonal, circularly polarised signals at 14 GHz are being transmitted from Martlesham to the satellite. The first low power signal is co-polar to the satellite receiver antenna while the second, of higher power, is orthogonal to it. In traversing the up-path, some of the higher power signal will be depolarised and received at the satellite. Both received signals are retransmitted, circularly polarised, to Martlesham at 11 GHz.

From the combination of signals received at Martlesham the up-path attenuation and depolarisation are simultaneously measured, and on the down-path circular and linear transmissions are directly compared. The Martlesham aerial is the only one in the UK carrying out up-path propagation tests and is one of only 10 in Europe offering such facilities.

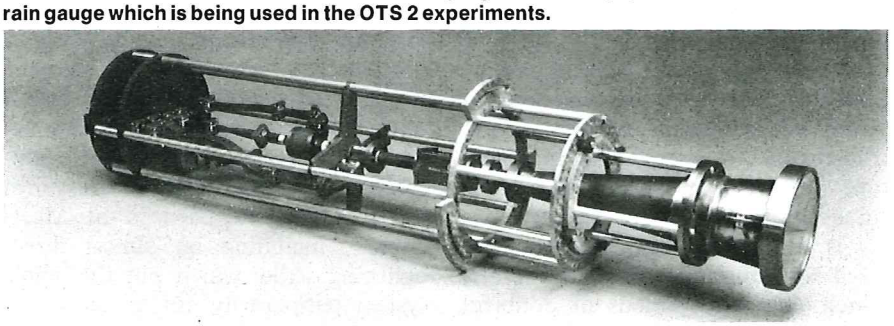
Four radiometers at 12, 14, 20 and 30 GHz, pointed along the OTS slant path, are being used for the measurement of 'sky noise'. The first two use a common 2m diameter front-fed aerial and the 20 and 30 GHz instruments, calibrated during earlier satellite experiments, use separate 0.6m aerials. The 12 and 14 GHz instruments, to be calibrated using the OTS beacon data, will be used to collect long-term slant path attenuation statistics and from concurrent relationships established between the four frequencies, interpolate and extrapolate data to other frequencies.

With careful construction, matching, characterisation and calibration, radiometers can measure attenuation to about 13 B with an accuracy of ±1 dB and, therefore, still have an important role to play in collecting long-term on-site co-polar data economically. A 12 GHz radiometer, constructed in Radio Division at Martlesham has recently been installed at Madley, the Post Office's second earth station near Hereford, for THQ Telecommunications Development Department and a second is under construction. The radiometers also have an important role to play in distinguishing true propagation effects from possible tracking errors or beacon instabilities.

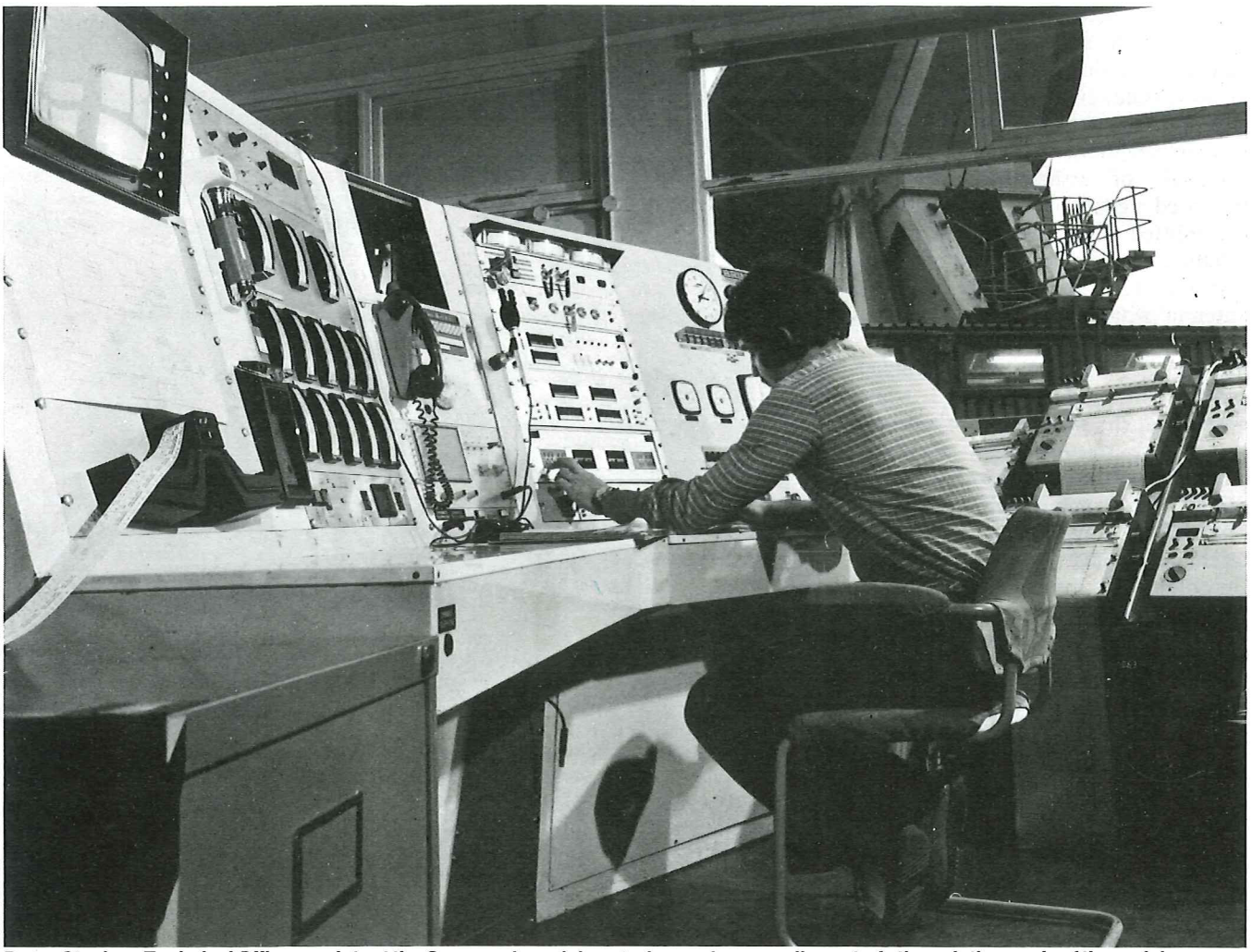
Other diagnostic instruments avail-

Executive Engineer Ray Bell calibrates one of the 12.1 GHz radiometers which are being used to measure 'sky noise'.

Technical Officer Vince Maund at work developing interface equipment for the rain gauge which is being used in the OTS 2 experiments.



A close up of the combined aerial feed which enables simultaneous reception and transmission of signals.



Roger Stuckey, Technical Officer on duty at the Cassegrain aerial control console manually controls the pointing angle of the aerial.

able during the experiments include a 9 GHz radar system, an electric field probe, a rainfall-rate gauge and wind direction and speed indicators.

Extensive use is made of chart recorders to monitor most parameters, but to permit detailed statistical analysis of the data from the 24-hour a day experiment, a Honeywell 716 digital mini-computer is used as the basis of the primary data handling system. A smaller Honeywell 316 system used during the earlier experiments acts as a limited-back up facility in the event of any main equipment failure and during maintenance periods.

The main computer disc unit acquires data at half second intervals from 16 analogue and six multiplexed digital inputs and when the level of one of the data inputs passes a pre-set threshold, the computer registers an 'event'. Only then is the data on disc transferred to permanent magnetic tape memory. Recording then continues for the duration of the event.

It is these tapes, subsequently analysed with reference to an error file, which eliminate periods of doubtful data that may only be retrospectively discovered for some of the channels. Using the Honeywell 716 and the Harmondsworth IBM 370/168 computers, direct graphical presentation of statistical data is produced by a high speed plotter.

During the Orbital Test Program (OTP) of June to December 1978, Martlesham played a full part in monitoring positional stability of the satellite and frequency stability of the on-board beacons as well as testing its own transmissions. Measurements were made of the Martlesham aerial patterns for each received parameter as well as assisting ESA in assessing patterns of the satellite aerials.

But for nine weeks the OTP was halted for propagation experimenters to obtain data during a period likely to contain the worst of the summer storms. This proved doubly useful since as well as being able to gain experience with the experimental equipment, some particularly severe storm 'events' were experienced at Martlesham, including an almost direct lightning strike which put the whole system temporarily out of action. In all, some eight or nine major 'events' have been experienced.

With interest mainly centred on infrequent 'events' which happen for a total of about an hour per year, the problems of equipment reliability are of considerable importance and it is ironic that mains breaks are most likely when good data recording is most needed – during thunderstorms for instance. To minimise lost data a system of alarms and an emergency attendance rota is in operation. No doubt when substantial thunderstorm activity is present or anticipated, some full-time attendance will be necessary.

Hopefully with these precautions and a stable OTS 2, a high proportion of reliable propagation data for system planners will be recorded. A combination of probability, theory and folklore should also ensure that there are not any more direct lightning strikes!

Dr R. G. Blake is a Head of Section in Radio Division at Martlesham responsible for terrestrial and slant path propagation data collection and aerial design at microwave frequencies.

Cable links across the desert

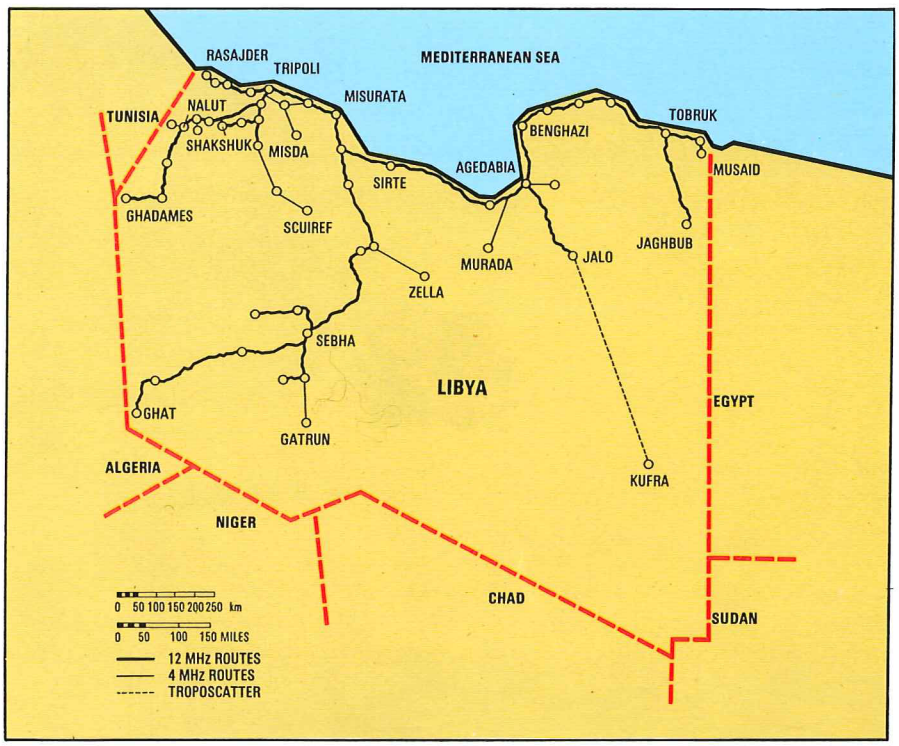
JF Boag and GCC Higgs

The Post Office's biggest ever consultancy contract – helping the Libyan Posts and Telecommunications Corporation (PTC) to plan, specify and construct an extensive new telephone cable network – has now reached the stage when tenders are being evaluated. This article outlines the work involved in the project so far, since the first team of Post Office technicians and engineers flew out to the oil-rich African State 18 months ago.

THE RAPIDLY developing Republic of Libya where new harbours, airports, roads and railways are being built at an ever increasing pace, has accepted that to realise the full potential of its investments, it must have the best possible telephone, telex, television and radio communications.

To help ensure that it achieves this the expertise of the British Post Office was called on at an early stage and as a result a contract, worth more than six million pounds, was signed. Fourteen Post Office staff from various parts of Britain ranging from Assistant Executive Engineers (AEEs) to Head of Group level have so far been seconded for the planning and adjudication phases.

The initial Post Office brief was to plan and specify the installation of more than 7,400 km of coaxial cable links within a 12 month period, throughout a country where climate and landscape presented enormous extremes. This was the first step in an overall deal which embraces initial planning, preparation of specifications and tenders, technical evaluation of tenders and on-site supervision of full turnkey contracts in what is nothing less than a major modernisation programme of Libya's telephone switching network.



Subscriber Trunk Dialling (STD) and International Direct Dialling (IDD) facilities are planned to be available to customers by 1981, and work is in progress on installing more than 100 new exchanges and exchange extensions. A submarine cable system connecting the two main cities, Tripoli and Benghazi, is due to be in service later this year.

In international communications, work is underway on a new submarine cable system to France, satellite earth stations, and additional links across land borders. Modern Stored Programme Controlled (SPC) telex exchanges are providing worldwide service, and two large SPC International Telephone Switching Centres are on order.

All these services require high-quality large-capacity communications links within Libya itself and the existing network of microwave radio relay systems is being widely extended and increased in circuit capacity to cope with the continuously rising demand.

For specification purposes, the new coaxial network was divided into eight phases to be delivered in sequential pairs to an agreed timescale. It was, however, essential to complete the whole network planning exercise and obtain PTC agreement on the choice of cable and system before the arrival of the survey team. This was to make sure that sufficient capacity had been allowed for other interconnecting and transiting routes.

Planning for the basic system had to take into account many different factors. One specific requirement was that the coaxial links should also provide 625-line colour television transmission facilities between the major cities. Data supplied by the PTC included voice circuit forecasts for the switched network, forecasts of private wires, and requirements for capacity for other services such as voice frequency telegraph systems, programme circuits and data transmission.

After completion of technical and economic studies, agreement was reached for the specification to proceed on the basis of 2.6/9.5 mm tube coaxial cable equipped with 12 MHz systems for the main long-haul routes, with smallbore 1.2/4.4 mm tube cable with 4 MHz systems on the shorter spur routes. The number of tubes in the cables varied from 12 over the high traffic density links between Tri-

poli and Benghazi to four in extremities of the network.

Television facilities would be provided in the upper part of the 12 MHz line system frequency spectrum. Other special features included a separate cable in the same trench as the larger main cables providing a highway communications system with telephone call points at two km intervals along major roads to provide emergency service to the nearest police post. The various phases of the project were to be specified in such a way that tenders could be invited internationally on a full turnkey basis, including the construction of any necessary buildings.

From the start of the first two cable phases, the survey teams had to contend with temperatures well into the upper 30s C (100 F), fine dust blown by hot desert winds which entered the vehicles and the occasional sandstorm which reduced visibility to a few metres making driving hazardous on the heavily used coastal road along which the first routes lay.

The terrain varied from flat, predominantly sandy, coastal plains with occasional salt marshes to wooded mountainous regions around Beida in the east, with the surrounding countryside varying from intensively cultivated agricultural land to seemingly endless landscapes of desert scrubland. Routes had to be found through major cities like Tripoli and Benghazi where large-scale road redevelopment projects are at an advanced stage, as well as to small townships in remote areas where development is planned, but not yet started, and where access is only by sand track.

Accompanied by local engineers familiar with the routes, the two-man Post Office survey teams travelled over each link, determining the practical line of cable track, the siting of buried repeater points, the location of any intermediate power feeding stations, and recording soil conditions and any other special features.

Consultations with the appropriate authorities took account of road improvement schemes, existing and planned high voltage electricity supply lines, and the development plans for the many townships and villages along the routes. Liaison with PTC staff determined the siting of proposed new buildings for housing coaxial terminal equipment, extensions to existing buildings, duct entries to cable chambers and internal cable layouts. The teams later prepared Straight Line Diagrams (SLDs), marked-up maps, duct plans and survey reports for inclusion in the specifications.

In far from ideal conditions work must continue and Bedford AEE Brian Powell copes despite a 'ghibli' — a fine desert sandstorm at Shakshuk.

Meanwhile, specialist teams in Tripoli and London were writing the first drafts of the technical specifications covering cable types, cable laying, jointing and installation of repeater cases, 4 MHz and 12 MHz coaxial line systems and all the associated voice, telegraph and television multiplexing equipment, including field acceptance tests, quality assurance requirements, training, documentation, spares, test equipment, power supplies, and project monitoring procedures.

In Tripoli they were also completing detailed planning for the remainder of the network so that multiplex plans could be finalised for the first two links, after which equipment quantities could be determined and floor space and power consumption data

Brian Powell with Land Rover, surveys part of the 12 GHz cable route surrounded by sand dunes on the Nalut to Ghadames road.

AEE George Robson from Plymouth discusses details of the proposed survey with local PTC technicians.

prepared for use by the survey teams when assessing the use of existing buildings or power plant.

As specification work progressed, a closely co-ordinated programme of submission and approval was agreed with the PTC. For the technical specifications alone, more than 500 pages of text were approved and flown to London for reproduction.

Problems concerning the next two link phases were just as severe. Weather conditions were generally good but the teams encountered torrential rainstorms which caused local flooding to considerable depths. Along these routes are located most of the major oil and natural gas terminals. Consequently the cable route crosses a number of largebore pipelines, presenting special problems in cable laying and protection. Discussions were held with engineering staff of the oil companies and arrangements made for prior consultation and joint supervision during the detailed planning and construction phases.

The following two links were the most difficult sections of route from a terrain point of view. The route to Ghadames branches at Azizia – where record temperatures have occurred – and one lower branch of the route runs along the base of the mountains while the upper route rises abruptly to heights of over 700 metres above sea level.

Roads ascend the mountains in sharp hairpin bends, where frequent encounters with heavy trucks, often towing trailers, made surveying a difficult operation. Rainfall in the mountains is often considerable, and the run-off results in many fast flowing wadis which cross the lower road by culverts or under bridges. The upper route was less rocky than expected, and when a scheduled new highway is completed, cable laying operations are expected to be relatively straightforward. On the high plateau beyond the mountains begin the sand dunes, reaching 100 feet high or more, and stretching over the Algerian border to the horizon.

Next came the longest routes surveyed, almost 1400 km, and once again the team experienced sandstorms, mountains, and a welcome stretch of good metalled road which suddenly reverted to a sandy track.

The final routes, between Tobruk and Jaghbub on the Egyptian border, and between Agedabia and Jalo, from where a troposcatter system connects to the Kufra oasis, were by comparison, relatively straightforward. Both routes follow good roads, with few cable laying or repeater siting problems. As with all the others these specifications were delivered on time.

With all specifications completed by the end of last July, work has continued with technical advice on preparing, issuing, and evaluating tenders and this important part of the exercise was brought to a successful conclusion by the end of the year. But there is still, of course, very much more to do . . .

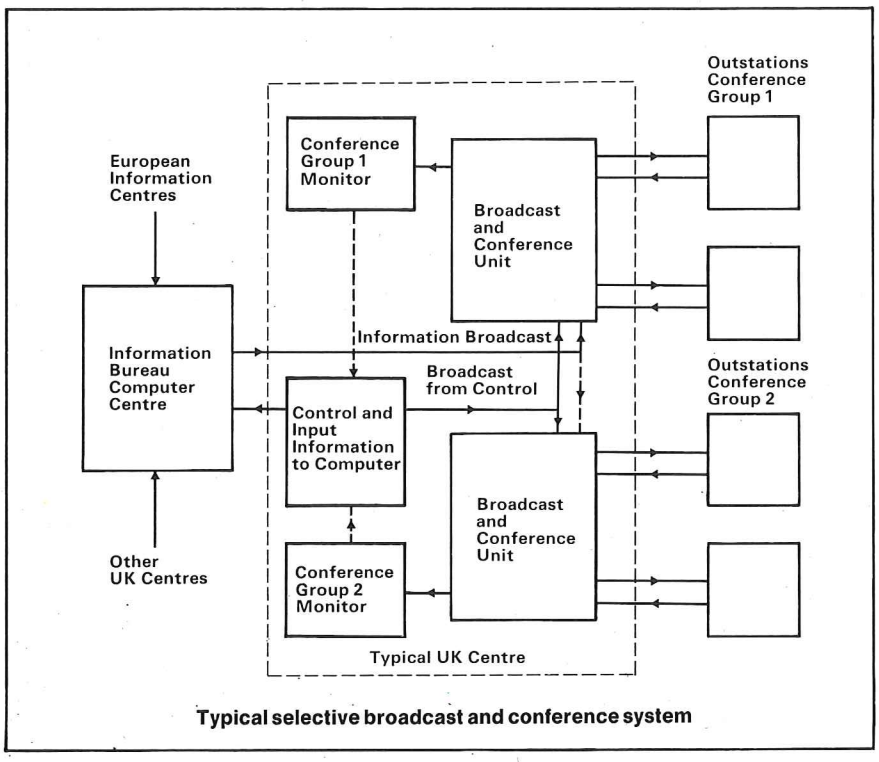
New development on the flood prone Qasr al Haj to Tigi road. A road bridge has already been installed and telecommunications cables must now be incorporated.

Mr J. F. Boag is Head of Line and Radio Systems Planning Division in Network Planning Department at THQ and Project Director of the Post Office Consulting Office.
Mr G. C. C. Higgs is the Project Engineer on the Libya coaxial cable project.

Hotel receptionist Miss Valerie Miller sends out a selective message to various hotel staff to warn them to prepare a room for the arrival of an important guest.

Add-on units spread the word

G A Routhorn and D J Kersley



Typical selective broadcast and conference system

FACILITIES for sending printed information such as news items, arrivals and departures of people and goods at hotels and detailed weather reports to many different places simultaneously, have long been provided by the Post Office. This has been done by the addition of suitable units to the ordinary page printing teleprinter used in private circuit systems for message transmission and reception on a simple point-to-point basis.

The technology used to implement these broadcast and conference facilities has always been based on older relays and valves. But now a new modular approach using semi conductors has been developed enabling the Post Office to provide systems more closely tailored to individual customers' needs as well as better service.

A broadcast unit has one input for receiving messages from a teleprinter and a number of outputs which may be connected via private telegraph circuits to receiving teleprinters. Each circuit has a send and receive path, but the receive path is not normally used. A conference unit uses both the send and receive paths for the transmission and receipt of messages between several teleprinters. This requires correct operating procedures to ensure that only one teleprinter is transmitting at a time and thus avoid garbled messages. Broadcast networks may have up to 150–200 lines while conference networks normally operate with fewer than 20 lines.

The new broadcast units receive telegraph messages at ±80 volts and transmit them via four outputs at the standard signalling voltage of 80 volts. The conference unit concentrates messages from four inputs and transmits the information on a common highway to an associated broadcast unit and from there to four outputs. The units can handle transmission speeds from 50 to 110 bauds with less than two per cent distortion. Six can be fitted to a standard transmission equipment shelf.

When the broadcast units are associated with filter units each shelf can accommodate 12 lines in a broadcast arrangement or be reduced to eight lines when associated with conference units in a conference arrangement. Both broadcast and conference units can be powered from either ±80 or ±12 volts supply with an on board power regulator to reduce the voltage to ±6 volts for the integrated circuits used in the units. Noise immunity and a wide tolerance on the power supply voltage are other features.

The broadcast units can be "built up" to form a larger system and there are no technical reasons why it cannot be extended to 1,000 lines or more. The test points on the front panel give access to the incoming and outgoing messages and each output is protected by a resistor bulb and a 200 ohm line resistor.

The input messages to a broadcast or conference system can be generated from a teleprinter, visual display unit (VDU), word processor or computer. The distance between the source of

Technician Alan Grenouilland provides a new circuit on the broadcast and conference system which operates between the City offices of Lloyds of London and their Intelligence Department at Colchester.

the message and the receiving teleprinter is limited by the transmission characteristics of the private wire circuits unless the message is regenerated. The broadcast unit can be situated near the source of the message, at the end of the telegraph private wire, or at intermediate points supplying messages in that locality.

Each output can be individually controlled by switches or grouped together and controlled by character recognition units to form a selective broadcast arrangement. This allows the recipients to be sub-divided into a number of groups with each being allowed access to some or all of the transmitted messages.

If the system is manually switched, the broadcast unit would be within reach of the operator supplying the input information, but if switching is required at the distant end, this would be done automatically by prefixing each message with a group address code and finishing with an end of message code.

The incoming line is monitored by a character recognition unit, which on receipt of a group address code, directs the incoming messages to the required group and on receipt of the end of message code, resets the system. If a group code is not sent, the message will be received by all groups.

For conference working strict operational procedure must be observed to prevent the mutilation of messages. The local record of teleprinters used on conference systems is obtained from the line via the conference system to ensure that the transmitted information has passed through the conference system. If two stations transmit at the same time a mutilated copy is shown.

To prevent the whole conference system from failing under a faulty line condition a detection circuit is provided for each input. When a fault occurs, or two stations call simultaneously, the detecting circuit comes into operation and the inputs concerned are disconnected from the system. Monitoring of the faulty line continues and when the fault is corrected the line is automatically switched back into service.

If there is a requirement for information from a number of recipients at two locations many miles apart it is often economical to divide the conference group into two and connect the two groups via a private trunk circuit. To prevent unwanted messages circulating through the second conference system and back on to the trunk circuit to the first system, a feedback suppression link is used. This is situated between the trunk input on the conference unit and the outgoing trunk on the associated broadcast unit.

The number of lines on the conference system can be increased by adding more units in the same way as on the broadcast system. When a larger system is required however, it is usually built up from a mixture of broadcast and conference facilities but with the addition of character recognition or manual switching, the facilities can be extended to include selective conference arrangements.

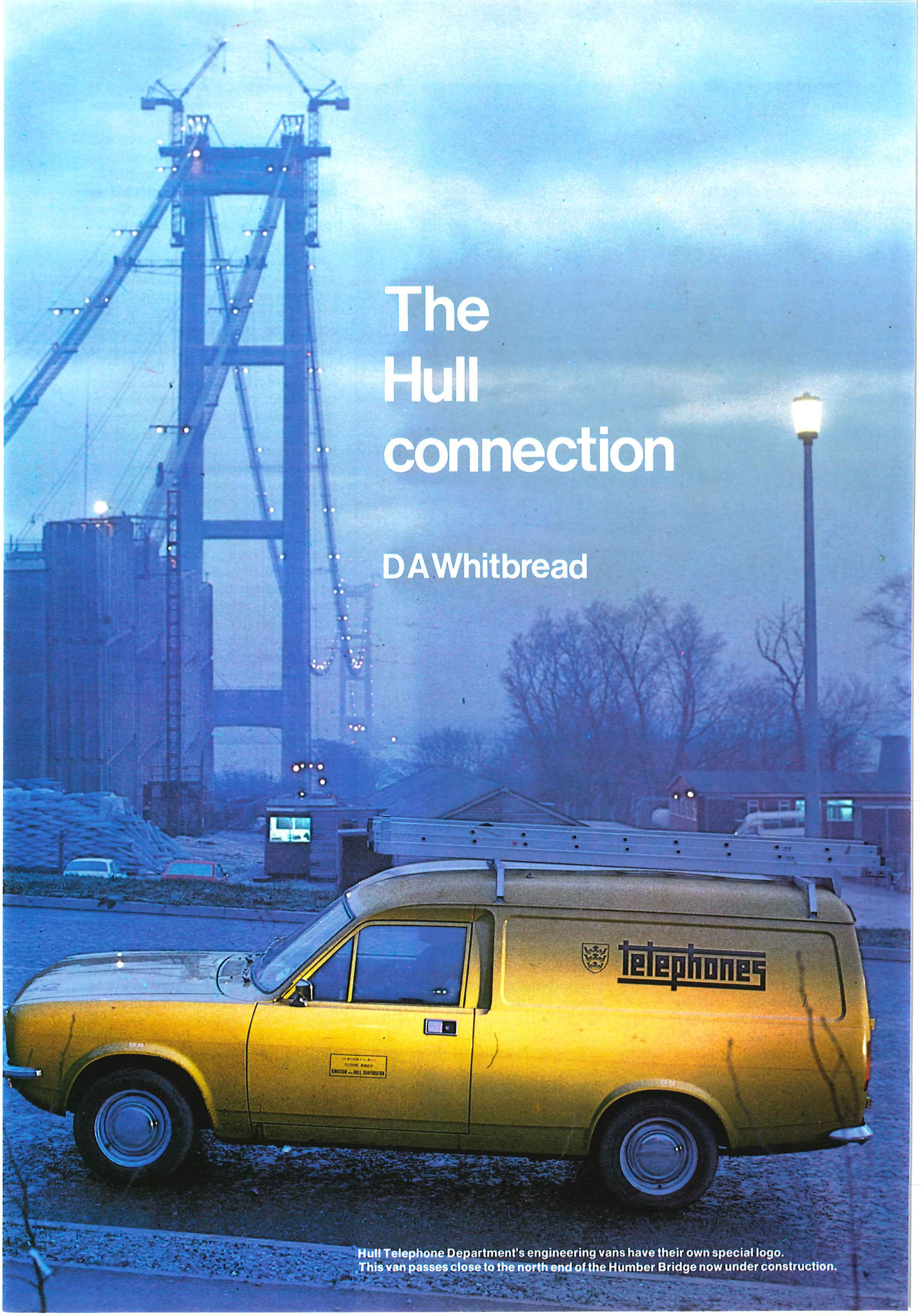
Provision of the new units meets a continuing demand for transmission at low speeds in the range six-12 characters per second. This enables Post Office standard teleprinters to be used as output devices if required. As the modular units become available they will enable the Post Office to provide system designs to suit customers' needs.

Mr G. A. Routhorn is Head of Section in Telecommunications Development Department's Telegraph and Data Systems Division with special responsibility for the development of broadcast and conference facilities.
Mr D. J. Kersley is an Assistant Executive Engineer in the same Division.

PO Telecommunications Journal, Winter 1978/79

The Hull connection

D A Whitbread



Hull Telephone Department's engineering vans have their own special logo. This van passes close to the north end of the Humber Bridge now under construction.

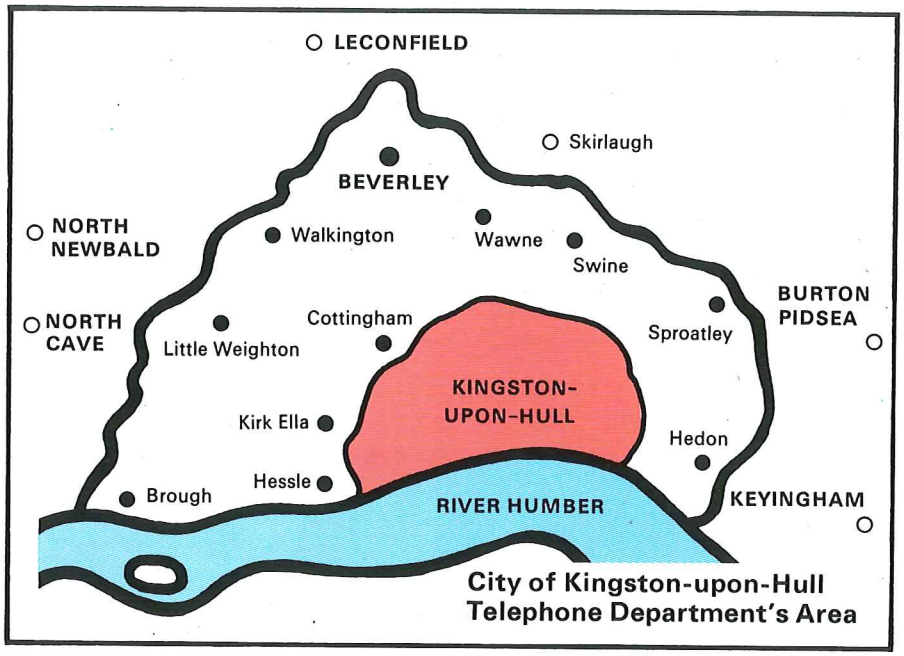
MENTION Hull and it will conjure up different things to different people. To some it will bring visions of trawlers and fishermen: to others it will mean a Rugby team or a spectacular new road bridge. Most Post Office Telecommunications staff, however, will immediately think of the independent local telephone service which for the past 70 years has been run by Hull City Council and remains the only public network in Britain not controlled by the Post Office.

Hull Telephone Department, with its distinctive cream telephone kiosks, operates under licence from the Post Office. It serves an area of some 120 square miles, roughly semi-circular in shape standing on the north bank of the Humber. At bottom centre is the densely urban City of Kingston-upon-Hull, skirted to the east, north and west by semi-rural terrain which includes Beverley, Hedon, Haltemprice and parts of Holderness.

It has a total of 14 exchanges, 13 of which are late-development Strowger types and the latest a Pentaconta crossbar, serving in all some 110,000 subscribers. Its outlet to the rest of the nation and the world is through a Post Office Group Switching Centre (65c) adjoining its own largest exchange. It has a staff of some 660 comprising 30 senior and middle managers, 110 clerical and commercial staff, 390 engineers, 70 operators, 60 manual workers and is headed by a Telephone Manager, answerable to the City Council's Telephones Committee.

Hull offers services closely similar to those provided by the Post Office including exclusive and shared lines, private branch exchanges (PBXs), renters' coinboxes, ancillary items such as loudspeaking telephones and repertory diallers. The main differences from the Post Office are that local calls are untimed and customers have a choice between an exchange line rental which includes 200 call units or a higher rental which covers an unlimited amount of local calls. All revenue from trunk calls accrues to the Post Office and it is for this reason that Hull's local call unit fees must be necessarily tied to those of the Post Office.

Hull's exchange service is basically a telephone service but provides a full range of private services within the licensed area as well as those parts of private services necessary for the Post Office to offer private services across the boundaries. Hull also provides circuits and parts of circuits for the Post Office telex service within, to and from the licensed area. And Hull is an innovator when it comes to recorded information services, having introduced, among others, a Santa Claus Christmas message, childrens' bedtime story, football result and pigeon liberation services.



Cream coloured telephone kiosks are a feature of Hull Telephone Department. This group is in the city centre.

Throughout its history Hull has managed to keep its prices for main services below those of the Post Office, particularly residential service, which perhaps accounts for its high degree of telephone penetration – some 80 per cent of all homes. How? Contrary to some assumptions, apart from initial setting up, the telephone undertaking has never been a burden on local rates but draws its funds from self-finance and loans, which it repays with inter-

Mr Ray Matthews, Manager of Hull Telephone Department, outside the City centre offices which are the Telephone Department Headquarters.

est. The area also lends itself to economic telephone development whereas the Post Office has the additional cost of providing service in more remote and sparsely populated areas of the country.

But what were the beginnings of Hull's unique telephone development? In 1898 a Select Committee of the House of Commons reported in favour of local telephone systems being operated by municipalities in competition with the National Telephone Company (NTC). The recommendation of the Committee was accepted and the Telegraph Act 1899 was passed, conferring upon municipalities powers to use rates and borrow, for the establishment of local telephone systems under licence from the then Postmaster-General.

There were 1,334 bodies which could have taken out a licence but only 55 wrote to the Post Office. A total of 13 took out a licence but only six, Brighton, Glasgow, Hull, Portsmouth, Swansea and Tunbridge Wells set up telephone services. Tunbridge Wells promptly sold out to NTC and Swansea followed suit in 1907. The Post Office bought out Glasgow and Brighton in 1906, NTC itself in 1912 and Portsmouth in 1913. Only Hull survives.

Hull Corporation applied for a licence in 1901 and a 10-year term was granted. The Corporation opened an exchange in November 1904 and by March 1906 had 1,895 telephones in use. Later that year it refused offers of purchase from the Post Office and National Telephone Company and in 1911, the year in which NTC's licence expired, operating in Hull were a Post Office system with fewer than 50 subscribers, NTC's system with some 9,000 subscribers and the Hull Corporation system with 3,000 subscribers.

With the Post Office takeover of NTC it was decided that Hull should continue its service as agent of the Postmaster-General pending completion of negotiations. Later the Post Office agreed to renew Hull's licence provided the Corporation also purchased the original NTC interests for £192,423. The Corporation agreed and new licences have been issued at intervals ever since. All have provided, however, that at the end of the licensed term, or if Hull became inefficient, the Post Office has the right to buy and run the system.

On 1 October 1969 the Post Office ceased to be a Government Department and became a Public Corporation. To all intents and purposes the then current Hull licence was unaffected. But the Post Office Act 1969 provided that in future the Post Office might grant licences only with either the general or specific consent of the Minister.

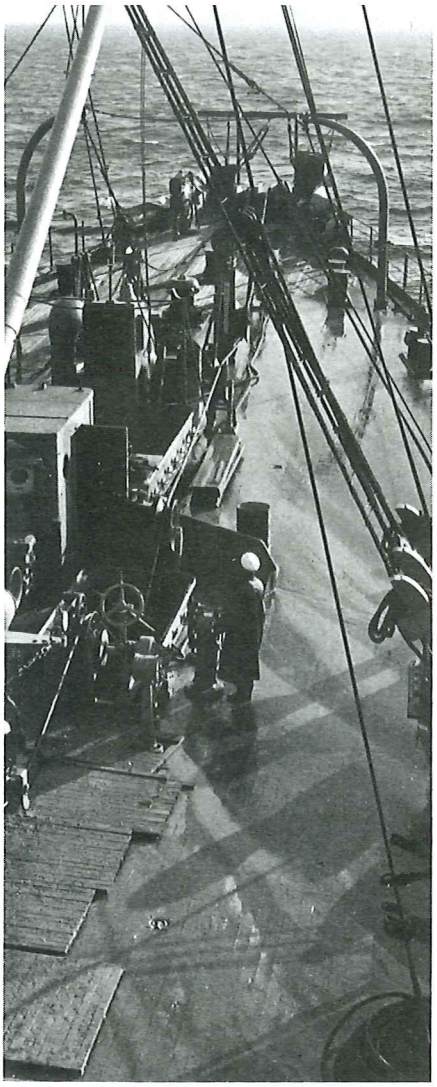
Some two years before the last licence expired the Post Office suggested a joint Post Office/Hull study of Hull's telephone undertaking and its future prospects. Hull City Council readily agreed and a Joint Working Party was set up. Subsequently it reported that the Hull Telephone Department, although differing in some respects from the Post Office, was providing an efficient and economical service and there appeared no overwhelming technical, operational or financial reason why it would not successfully continue for another 10–15 years. The Post Office recommended to the Secretary of State for Industry conditions under which the licence might be renewed, and he announced his consent to a new 12-year term in the House of Commons on 23 June 1978.

Until the new licence, Hull paid the Post Office an annual royalty of 10 per cent of its gross income – a payment which in the past occasioned much debate as to its justification both in concept and level. What evoked less interest was that at the same time Hull was allowed to retain five per cent of the trunk revenue it collected on behalf of the Post Office, an annual sum which offset the royalty payment by a significant amount. Now under the new licence, Hull will pay the Post Office an annual licence fee based, at its origin, on £100,000 and updated annually in proportion to changes in the Retail Price Index.

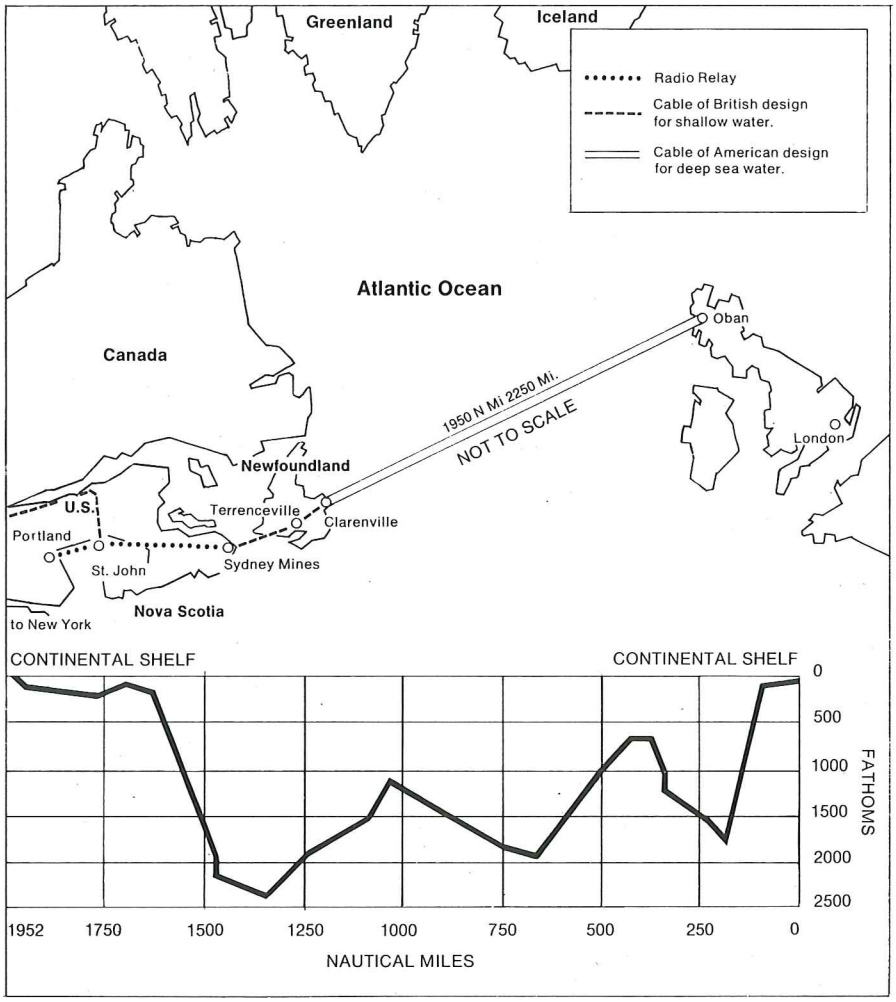
The question is still debated as to whether the Post Office should have sought to take over Hull when it had the chance. Many valid points of view were considered from technical, operational and financial experts in the Post Office, from Hull City Council representing its citizens and from Hull Telephone Department itself. And ultimately, of course, there were the views of the Secretary of State for Industry having considered the situation as a whole.

Probably the strongest argument of all is that Hull Telephone Department exists and works satisfactorily. The die has been cast. Let us wish it well for at least another 12 years.

Mr D. A. Whitbread is Head of Group in Telecommunications Marketing Department and his responsibilities include liaison with Hull Telephone Department. He led the Post Office team in the recent Joint Study.



Former Post Office cableship Monarch in mid-Atlantic during the laying of TAT 1 in 1956



An era ends...

QUIETLY and without official ceremony in the UK a pioneering chapter in Post Office Telecommunications history came to an end late last November when TAT 1, the first transatlantic telephone cable linking Britain and the North American continent, was retired after more than 22 years in service.

The occasion was marked in the USA with a dinner, to which Mr John Hodgson, the Post Office's Senior Director, External Telecommunications, sent a commemorative message.

TAT 1 was laid across the ocean bed in 1955 and 1956 and ushered in a totally new era for telecommunications. Linking Canada and the United Kingdom with through connections to the United States of America, it stretched from Oban in Scotland to Clarenville in Nova Scotia and provided 36 high quality circuits. These replaced the sometimes unreliable radio circuits which until then had been the only means of telephone communication across the Atlantic Ocean.

The full TAT 1 system comprised two uni-directional cables linking Oban with Clarenville each 1,950 nautical miles long with 51 repeaters; a single two-way cable 330 nautical miles long across the Cabot Straits with 16 repeaters and a microwave radio-relay system which extended the circuits through Canada to the United States of America.

The cables were laid by Post Office cableship Monarch and in all its years of constant operation there were no technical faults on the system, interruptions that occurred being mainly due to damage caused by fishing.

When, in the early 1960s, the first of the communications space satellites was launched into the expanding world of international telecommunications, there were many who forecast a diminishing role for undersea cables. As development have shown, this has proved to be far from the case. Indeed, the two media are highly complementary and plans are already underway for yet another transatlantic cable to be ready-for-service in 1983.

But it was the laying and successful operation of TAT 1 which has earned a genuine place in telecommunications history . . . and not simply for opening up new markets. The need was for a system spanning the Atlantic to function and survive on the ocean bed at depths of up to two and a half miles without attention for more than 20 years. The courage and ability of the pioneers on both sides of the Atlantic has been triumphantly vindicated by TAT 1's 22 years of service.

And finally an interesting cost comparison demonstrating the advance of cable technology: TAT 1 cost about £15 million in 1956 at that year's prices which works out at about £420,000 per circuit. TAT 6, the most recent transatlantic link, cost about £26,000 per circuit in today's money.

In a man's world

In the eighth in our series on some of the many different jobs essential to the efficient operation of Post Office Telecommunications, Mrs Gillian Cox, a Technician in the Post Office's Factories Division at Birmingham, describes how she came to work in what is traditionally a man's world.

Mrs Cox at work on a faulty relay set.

AS ONE OF only four female Technicians working on the Post Office's Birmingham "factory floor" I am now quite used to the question: "What's a girl like you doing in a place like this?" And the answer is always the same: "Enjoying myself."

Yet it could have all been very different. In my last year at school I faced a dilemma. I wanted an interesting job but of those open to women nothing much appealed. Then my father, who works in the Post Office Supplies Division, came to the rescue. He suggested a job in the Post Office and when I saw a local newspaper advertisement for Trainee Post Office Engineers – open to both male and female school-leavers – I wasted no time in applying.

After an aptitude test and interview I was accepted as a Trainee Technician and on my first day in the Post Office, arrived to find I was one of only two girls among a class of 25 lads. Basically, the odds have remained the same ever since!

The first two years were spent as a Trainee in the Factory's Training School, with one day and two evenings a week at a local Technical College studying for Ordinary National Certificate in engineering. After overcoming my initial shyness I soon settled down and thoroughly enjoyed my new found equality. I also learned to become very broad minded...

The training programme was wide and varied. I studied mathematics, electrical and mechanical science and physics, and quickly learned how to make fine adjustments to a 3000 type relay and how to read the many different types of wiring diagram.

One week in every three was spent in making a small set of tools which provided a basic knowledge of using machinery like lathes, bandsaws and

After completing the necessary repairs to a uniselector, Mrs Cox submits her work to Production Inspector Peter Jerome for approval.

Morning coffee break reveals the extent of the man's world where Mrs Cox is a regular in the "card school".

drilling machines. I even learned to turn my hand to welding.

Then suddenly, the other girl on the course left at the end of the second year but I was determined to finish my training – which I was finding more and more absorbing – particularly as I had begun dating one of my course colleagues who, last year, became my husband.

After two years in the training school, I was sent on a fortnight's course around Birmingham's three factories, spending a day in each of the different shops before finally being placed in one of them to complete the last year of my training.

During this period my work was checked at every stage but after a few weeks I was allowed to tackle complete jobs. Eventually I was presented with my certificate and re-graded Post Office Factory Technician – a big day indeed.

At present my work is concerned with the repair of testers and relay sets from Strowger exchanges and I find it both interesting and varied. It is done in a traditional manner with each individual Technician working alone repairing a number of relay sets or units at a time. At present all jobs are done on a piecework basis with prescribed times allotted to different kinds of relay sets – an excellent incentive to increase earnings.

The many different kinds of relay set make repairs a constantly changing business. One of the most important aspects is quality and accuracy. If the Technician's work is not good enough then it is returned by one of several Production Inspectors whose duty it is to scrutinise carefully each finished job of sets. Some can be very, very particular!

Unfortunately in the seven years since I took the plunge into a so-called man's world I do not know of any other girls doing the same – which is a great pity. Working among the men at Birmingham provides satisfying, technical work which is a real challenge but well within the reach of many girls if they would only give it a try. And I think I am particularly lucky because if I ever have a work problem, my husband's bench is only 50 yards away – and he always knows the answers!!

Behind the figures...

The recent decision to publish detailed information about the quality of its Telecommunications services in booklet form is an important step forward in the Post Office's obligations to be more open with its customers. In line with this approach, Telecommunications Journal's next few issues will carry a series of articles which will discuss the background to the figures by which the total customer service is measured.
In the first, **Mr R. H. Adams,** Deputy Director, Telecommunications Service Department, looks at the basic automatic inland telephone service. Future articles will cover other key areas such as Operator Services, Repair Service, International Service and perhaps, most important of all, the quality of service as seen by the customer himself.

ALTHOUGH there is an increasing rate of diversification of services and products, which are all important to the on-going future of the Business, the basic automatic telephone service is still the dominant area of Post Office Telecommunications and is likely to remain so in the foreseeable future. The customer rightly expects all call attempts to be successful and the problems of designing and maintaining a network capable of achieving this are of no concern to him; a call failure is a failure of the Business.

There are two main measures of the quality of network performance, both based on Telecommunications Improvement Plans. The first provides a measure of the quality of service in the local dialling area and the second for the Subscriber Trunk Dialling (STD) service. Figures one and two (opposite) show the average daily call success rate and the four main reasons for failure. In both local and STD services the customer has experienced a steady improvement on the call success rate and in both cases the main improvement has come from the reduction in calls which fail due to the Post Office, either from inadequacy of plant provision or from defects in that plant.

A success rate of around 65 per cent does not seem particularly good and without doubt many telephone users find it difficult to believe in the low failure rate claimed to be due to the Post Office. Factors which foster this impression are several. The figures are averages over the "business day" and although the results are weighted to take account of traffic variations over the whole day, some customers at times experience much worse Post Office failure rates. Inevitably it is these impressions which remain.

Secondly, few customers would readily admit that they may make errors in setting up calls. But the fact that a caller persists in attempting to complete a call is clear evidence that he is unaware that he has made an error.

Then there is the considerable percentage of calls which fail because the called customer is already engaged or fails to reply. From the Business point of view the system has performed as required and the call only fails for reasons beyond Post Office control. To the customer, however, it is a failed attempt and subconsciously or otherwise he puts it down to the system. He is after all, only interested in success and it is this which forms his subjective impression of the telephone service, and with it his general view of the competence of the Business. Finally, there is the omission from the STD measurements of a significant part of the network.

But how in fact, is the quality of the telephone service measured? At present it is done by Telephone Service Observations (TSO), which are taken by specialised operators, who also monitor the quality of the operator services. This system will be discussed in greater detail in a subsequent article but for now it is sufficient to say that the operators monitor the success, or otherwise, of a random selection of calls through the business day.

Monitoring is at the first common equipment point in the switching system for calls in the local dialled area, thus omitting from the measurement the customer's line and apparatus and the exchange equipment dedicated to his line. For STD calls, the measurement is taken at the register access relay set in the Group Switching Centre (GSC) – the input to the trunk network: This means it omits from the measurement unsuccessful calls in the chain between the customer's equipment and the access relay set.

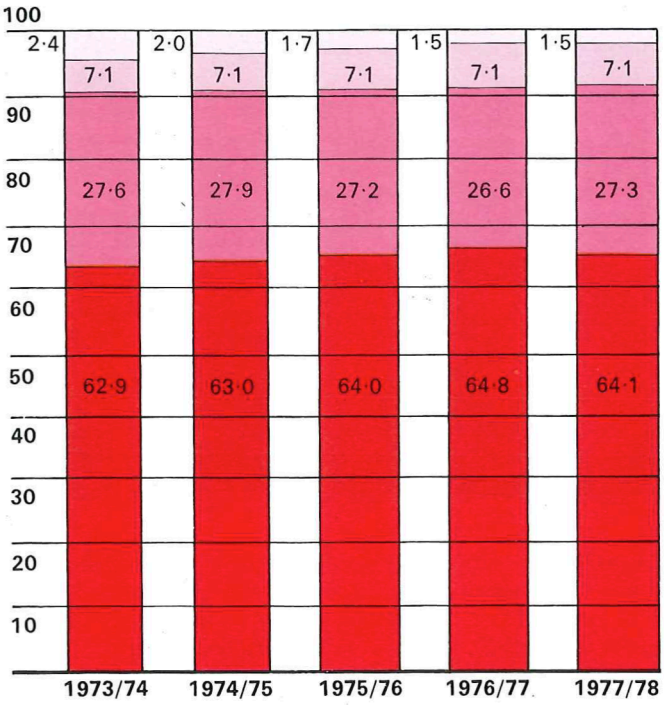
While TSO measurement has been a good monitor of network performance in the past there is now a need for not only a better method but also for an aid to maintenance engineers in the identification and location of obscure faults in the network. The defects of TSO are that reliable feedback on the effects of maintenance actions is too slow and there is little information available on the performance of a single exchange because of the tiny proportion of calls in a sample which are own exchange only. Also because of the high cost in a manual system of

LOCAL AUTOMATIC TELEPHONE SERVICE

fig. 1

Percentage of calls connected/failed

National averages

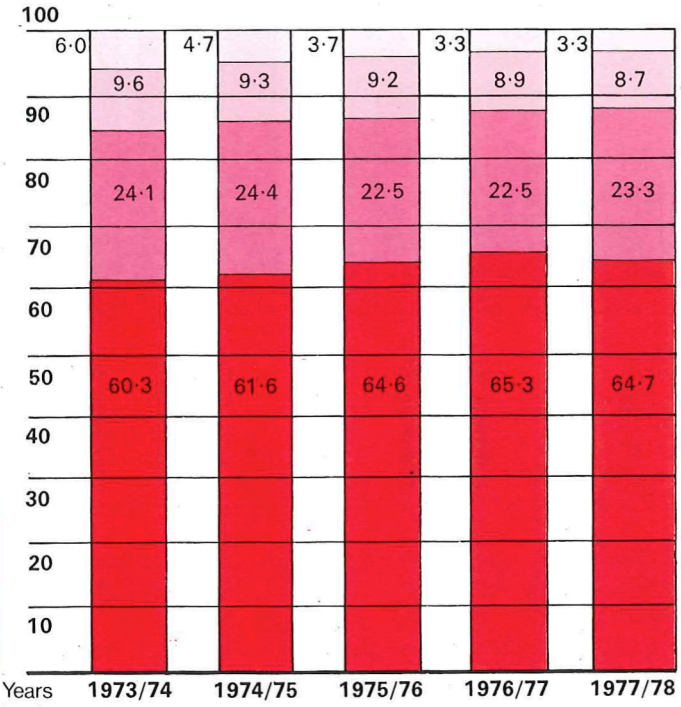


STD AUTOMATIC TELEPHONE SERVICE

fig. 2

Percentage of calls connected/failed

National averages



KEY

Calls that fail due to the Post Office
Include those caused by equipment faults or insufficient plant.

Calls that fail due to the customer
Include calls abandoned prematurely, incomplete dialling, and dialling wrong or unavailable numbers.

Calls which obtain 'engaged' or 'no reply'
These calls have passed through the PO network satisfactorily but fail because the called number is engaged or there is no reply

Calls connected successfully

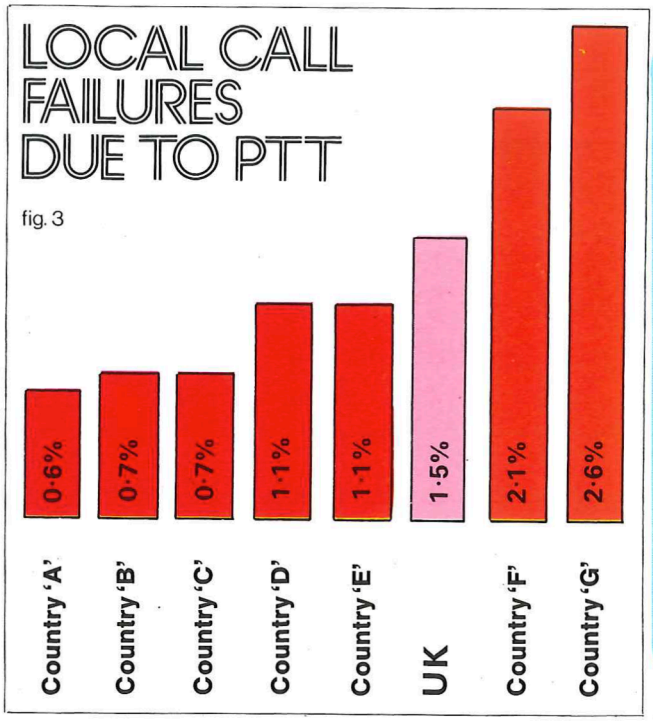
Executive Engineer Bob Brown of Telecommunications Development Department removes a cassette from the computer to obtain the monthly results from a MAC. These then undergo national analysis.

Quality of service is measured at telephone service observation centres. Staff record on punched cards, for later computer analysis, whether random samples of calls are successful or, if not, the reasons for failure.

obtaining adequate sample sizes for the smaller traffic groupings, important parts of the network are not systematically monitored.

Yet another drawback is that trends take too long to be revealed and the results, though valuable as historical records of the system performance, are not much use for day-to-day management of the network which is aimed at rapid improvement of the customer service by elimination of service-affecting faults, blockages, etc.

To help overcome these problems a new computer controlled system, known as Measurement and Analysis Centres (MAC) (see Telecommunications Journal, Winter 1976–77) is currently being introduced. Progress on the first 10 is fairly well advanced and national implementation of one MAC



Sequence	Function	Calls per month
1	Own exchange – from line circuits to test numbers within the multiple of the same exchange.	1000
2	Local dialling area – from line circuits to test numbers in the multiple of exchanges to which non-STD access if provided.	480
3	STD – from line circuits to distant exchange test numbers obtained via the 2-wire switched STD network.	280
4	STD originating – from line circuits to test numbers in the GSC served by the local exchange.	480
5	STD terminating – from incoming trunk selectors at GSCs (or incoming trunk units) to test numbers in the multiple of exchanges served by the GSC (or incoming trunk unit).	1000
6	IDD originating – from register access relay-sets in a GSC to test numbers in the UK international switching centres.	200
7	Tandem – from first selectors in tandem exchanges (DIR areas only) to test numbers in the multiple of local exchanges connected to the tandem exchange.	1000
8	Transit access – from a register access relay-set in a GSC to test numbers in exchanges served by that GSC but routed via the serving transit switching centre.	480
9	Transit multi-link – from register access relay-sets in a selected GSC each month to test numbers in the multiple of local exchanges obtained via the transit network.	1000

Tests generated by a MAC computer.

system per Telephone Area will be virtually completed in 1982.

MAC has been designed to provide continuous surveillance of the service throughout the day with the object of achieving a performance measurement for every exchange of 1,000 lines and over and every GSC. The system operates by sending a comprehensive pattern of test calls from each exchange in the system throughout the network using plant available to the customers. The resulting measurements are sufficiently sensitive to detect small changes in performance in any of the test pattern sequences thus highlighting the need for action. In addition individual call failures are printed out for immediate investigation by the local maintenance staff.

The table above lists the tests generated by a MAC computer and the much improved coverage of the network performance is obvious. Many other telecommunication administrations use test call sending as the basic method of assessing the performance of their networks – the Bell System of the USA is a significant exception – but the Post Office believes MAC to be a substantial advance on anything in use elsewhere. It will, incidentally, still be necessary to continue with TSO after the full introduction of MAC, but at a reduced level, to obtain the information on the calling and called customer results.

Perhaps at this point it is as well to establish what standards of performance are being aimed for. One of the great imponderables for a telecommunications administration is in deciding what level of service is right. Generally, to achieve a better automatic service with a given technology requires more plant or better use of what there is, a better standard of maintenance, or both, and this costs money.

The difficulty is in arriving at the correct balance of customer service and costs. And here there is a problem. In a competitive situation a business is soon made aware of the customers' views because "they vote with their feet" if they feel that a competitor offers better value. In the monopoly position of a public utility this instant and ready feedback, and with it a healthy discipline on the organisation, is missing.

As there are no ready internal criteria for arriving at the "right" answer there is a lot of sense in looking overseas at what other countries achieve and imparting, if not the reality of competition, at least the competitive spirit. There has been in recent years, therefore, considerable effort devoted to finding out what service customers receive in other countries and using the information as a yardstick against which to measure performance in Britain.

There are, however, difficulties in obtaining certain information and fully understanding the results achieved in other countries. Among the hazards facing those making international comparisons are the obvious ones of language and terminology, differences in the points and times at which measurements are taken, how they are taken, the complexity of the network, the technology mix of the system, and definition of types of call.

Fig 3 (above, left) shows local call performances for a number of other countries with the UK for reference. Because foreign countries only provide the information on an "In Confidence" basis the sources are not identified. On the basis of these figures the Post Office is holding its own on the local calls given the composition and nature of its system. Because of the vastly different ways of measuring trunk call performance, notably in the treatment of congestion, it is not possible to construct a similar pillargraph for STD calls. The international comparisons, however, do indicate that the Post Office has some way to go to be competitive in STD performance.

This is a reflection on the fact that while modernisation of local exchanges has made some progress, the trunk network remains predominantly Strowger equipped. There should be substantial improvements in the Post Office's relative position as System X begins to bring the trunk system up to date and as MAC begins to assist in the removal of difficult faults in the whole system.

In conclusion it is perhaps of interest to note that other countries achieve much the same order of successful calls, around 65 per cent, suggesting that UK customers are as error prone as everybody else.

PO Telecommunications Journal, Winter 1978/79

It's radio by phone...

B W Fielding

SINCE THE introduction of local commercial broadcasting in this country the "radio phone-in" facility has become increasingly popular. Recently, however, a new variation on this well-tried theme has begun to command attention.

Known as tele-radio, it began on Merseyside as an idea to stimulate telephone traffic, by making a local radio service available over the public telephone network. It has since spread to Manchester, Plymouth and Swansea and several other centres are actively involved in preparations to launch similar services in their areas.

At first all services were derived from independent local radio stations but late last year Liverpool achieved another first when Radio Merseyside became the first local BBC station to be just a phone call away.

The thinking behind the scheme is that even in these days of the ubiquitous transistor, regular radio programmes, especially news broadcasts still have a healthy market via the telephone. In Liverpool the first approaches were directed to Merseyside's own local radio station "Radio City", and response was enthusiastic.

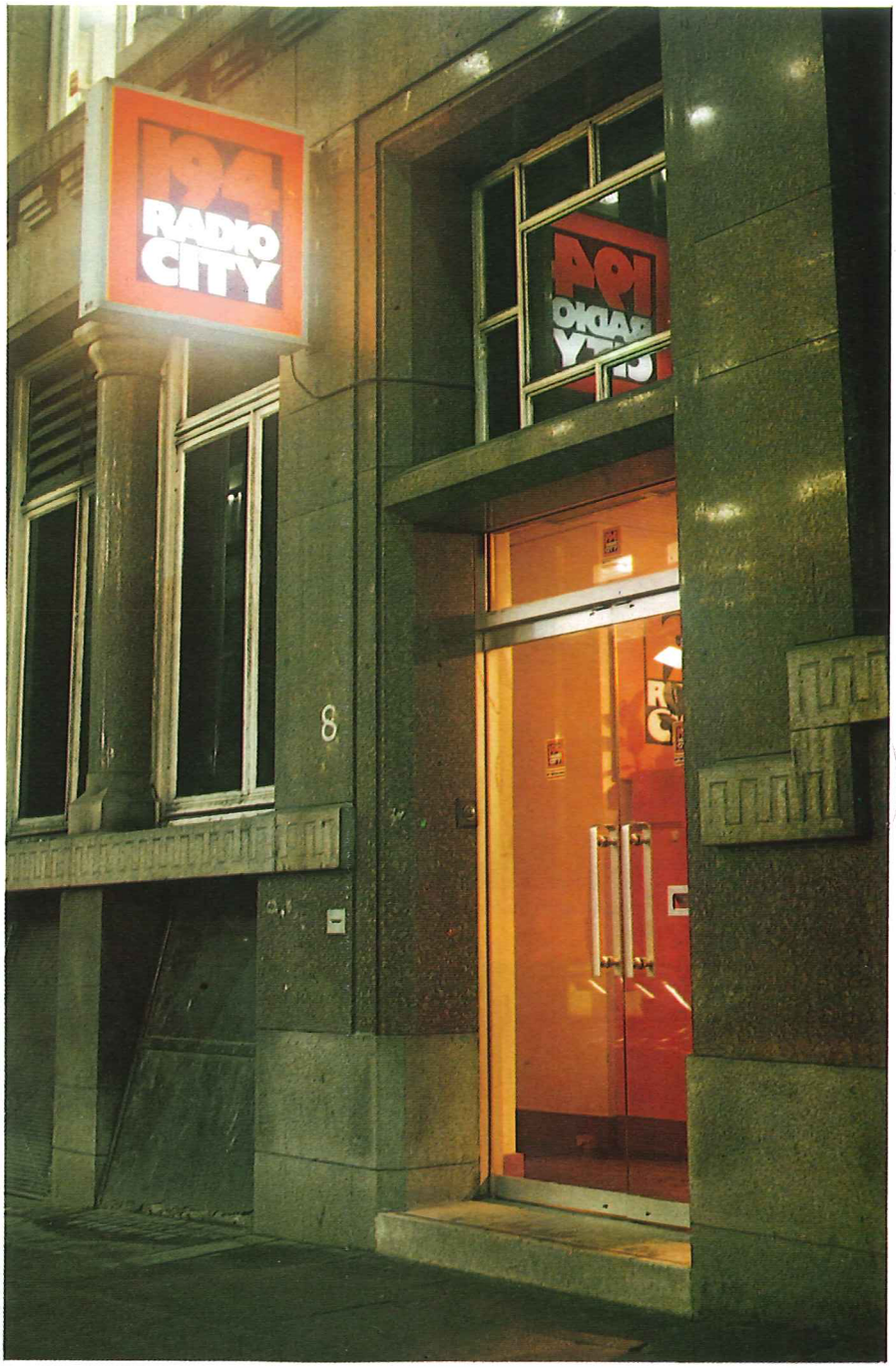
Radio City 194 (Sound of Merseyside) was ideally geared for such a service. The programme content is largely "pop" music with news broadcasts every hour together with other regular features. The news, of course, is particularly local and the station – broadcasting 24 hours every day – claims to be the most popular local radio station in the country.

Detailed examination showed that there would be no technical problem in setting up a service and it was decided to go ahead in the Liverpool Director (051) area for a trial period of six months. The dialling code "194" was spare except for minor use at Christmas so, as it was Radio City's medium waveband, it was a natural choice for the new service. Estimates of likely traffic were very much guesswork and the only acceptable plan, therefore, was to provide as much equipment at the outset as could be made available.

In fact the whole job was relatively small both in terms of cost and man-hours. After various grading re-arrangements to make available a tandem level with the relay sets and meters as well as provision of director translations, an amplifier was designed, built and connected to a feed from the broadcast studio. An early decision was to dispense with standard forced release as it seemed unacceptable to disconnect a caller in the middle of a news bulletin.

The philosophy, therefore, was to let people listen, at the local rate, for as long as they wished: a decision reached after careful consideration of the possible consequences such as congestion, as almost certainly main demand would come during the day when people did not have access to a radio.

A few small and potentially critical



The Radio City studios in Liverpool.

Technical officer Colin Dullighan checks the Radio City amplifiers at Liverpool Tandem Exchange.

A Liverpool Area engineering van spreads the Radio City message.

routes were augmented at little cost and a fall-back arrangement of fixed-time forced release was incorporated, on keys which could be operated if necessary. To avoid routes being swamped by tele-radio calls, it was also arranged that traffic would only have access to a proportion of the total circuits on the route.

Finally, financial agreement was reached to pay royalties to Radio City and to the two record societies for extended use of "needle time" on the basis of a percentage of metered call revenue. The service opened in 1977.

In the first four weeks calls poured in to the tune of 128,000, 107,000, 89,000 and 76,000. As expected, initial curiosity traffic gradually declined until it settled down to 60,000 calls per week which has been the steady average now for many months. Excluding the Speaking Clock, calls to tele-radio exceed by a substantial margin the total calls to all the other information services combined, including Dial-a-Disc – in itself a very popular service – which has not been affected by the introduction of tele-radio.

The news has proved most popular. Typical peaks of interest were reflected during the Jubilee visit of the Queen, the start of the football season, the mini-budget in October 1977, delays and disruptions to local transport, aircraft hi-jackings, evening football matches and notably, the 1978 budget when 4,400 calls were recorded in an hour during the live broadcast of the Chancellor.

It is, of course, uneconomical to provide sufficient equipment to meet full demand during the five minute news bulletins, particularly when there is something important occurring. Some congestion inevitably occurs on the 194 relay sets at these periods but because of the Post Office's route restriction measures and incomplete overflow readings it is not possible to determine demand with accuracy.

Prompted by the success of the Liverpool venture, Manchester were quick to appreciate the value of the service and soon opened negotiations with their Independent Radio station, Radio Piccadilly, broadcasting on 261 metres. A service was successfully opened on "261" for Manchester (061) area telephones late in 1977 and this has attracted about the same quantities of traffic as in Liverpool. Plymouth opened early last year (1978) with their "Plymouth Sound" and Swansea Sound followed soon afterwards. In both cases the station wavelength was able to be incorporated in the number.

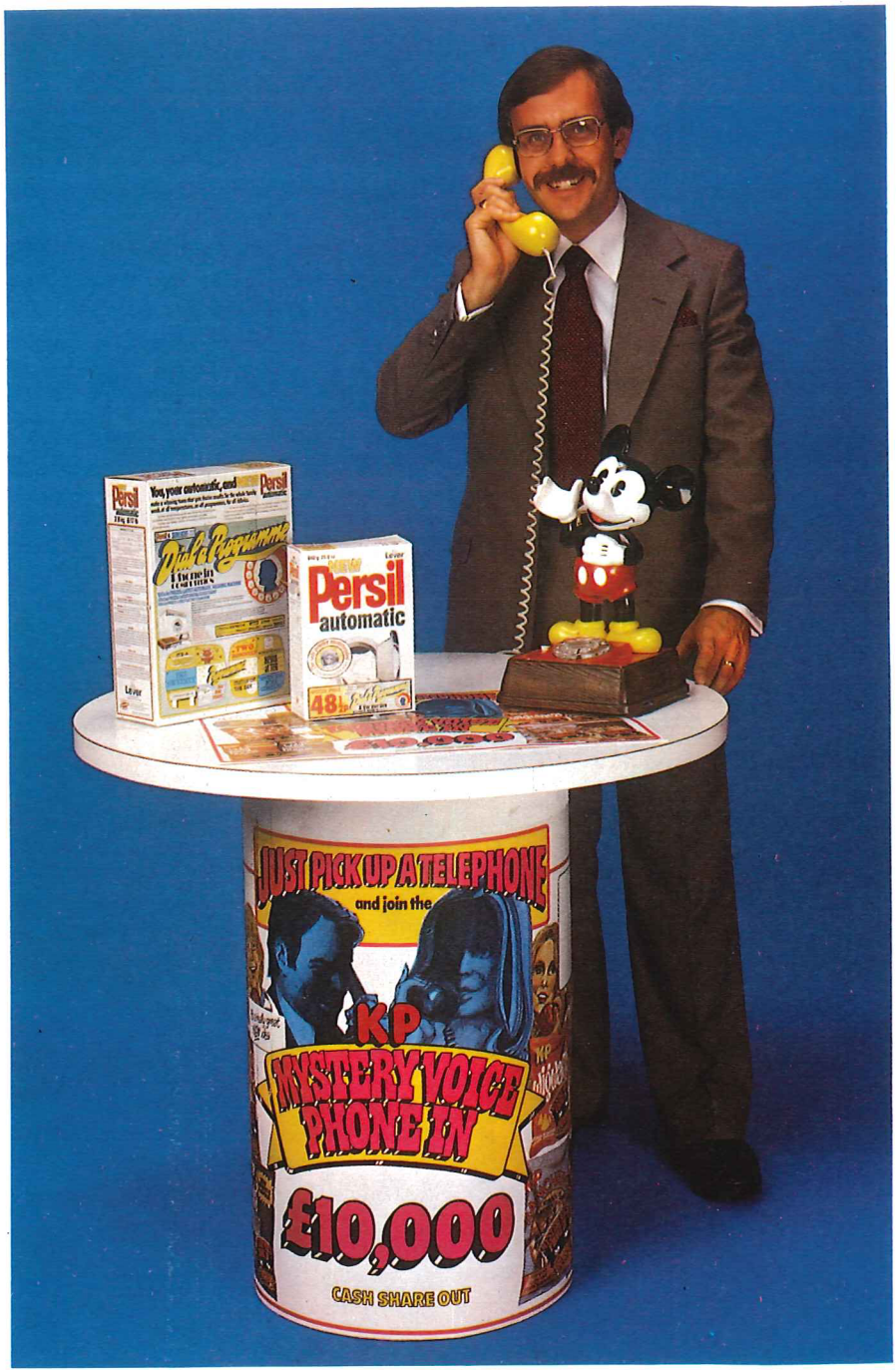
In its first year of operation Liverpool "194" clocked up $3\frac{1}{2}$ million calls with no interference to the public network, no failure of service and superb transmission.

What then of the future? Radio stations have the journalistic and broadcasting expertise, the Post Office has a distribution facility and from the successful start so far it looks highly probable that a combination of the two can produce much more traffic than any of the other information services.

There are some problems with codes but none of which is insurmountable. The three digit code reflecting the station wavelengths attracts attention, and consequently traffic, but it is often in ranges which cannot be used in non-director areas. With a little ingenuity, however, such codes can be incorporated ... as Plymouth and Swansea have already shown.

Mr B. W. Fielding is Head of General Services Division in Liverpool Telephone Area.

PO Telecommunications Journal, Winter 1978/79



...and prize competitions, too

R H Christy

PRIZE competitions have long been a favourite feature in newspapers and magazines but in the last couple of years more and more manufacturers have become aware that the telephone is an equally attractive way to promote their products. And for the Post Office the move is another valuable boost in its call stimulation campaign.

The first big phone-in competition was run in late 1976 by United Biscuits on their KP snacks range. Callers were asked to dial one of the numbers given on the packs, listen to a recording and then identify the two mystery voices that they had heard. The competition was a great success, with manufacturers delighted at the response from customers. The Post Office was equally pleased at the number of calls to the competition – nearly one million in four months.

This first competition sparked off a great deal of interest and KP were soon joined by other organisations anxious to promote products ranging from washing powder, Mickey Mouse and peanuts to yoghurt, and slimming aids. For the Post Office it meant hundreds of thousands of phone calls.

Last year, national competitions were run by Unigate and Lever Bros., and one of the phone-ins running at the moment features 'Jif' scouring cream in what is known as the "Round Britain" competition.

So far, these competitions have involved providing telephone lines to premises of the customers' choice – there are usually about six locations for a national competition – with answering machines supplied either by the Post Office or privately, depending on the needs of the customer, and the Post Office's resources at the particular time.

But such has been demand for phone-in competitions that the Post Office hopes to mount a trial of an improved service in the near future using purpose-designed equipment developed by Telecommunications Headquarters' Service Department. This exchange-based equipment will offer greater convenience and flexibility to customers, eliminating abortive temporary service installations. It will also considerably reduce maintenance effort and allow a much wider variety of use. There will be 10 centres nationally where the equipment will be installed, with up to 30 lines available in each provincial location and 40 lines in London.

Basically, the new equipment will enhance the service already provided by the Post Office and it is bound to boost the popularity of an already successful venture, by enabling Telecommunications Marketing Department to enter a far wider market for phone-ins than has previously been possible. It will be interesting to see how the idea develops . . .

Mr R. H. Christy is a Senior Sales Superintendent in Sales and Installation Division at THQ Marketing Department working on call stimulation and recorded information services.

PO Telecommunications Journal, Winter 1978/79

Memories on Man

The article "Island Outpost" which in the last issue of the Journal described telecommunications developments on the Isle of Man, has stirred the memories of three eminent former Post Office men who during the Second World War were involved in vital work on the Island which unbeknown to them at the time, resulted in the development of a world "first."
Here **Mr J. K. S. Jowett,** former Deputy Director of Telecommunications Development Department, **Prof J. H. H. Merriman,** ex-Post Office Board member and Senior Director, Development and **Sir Albert Mumford,** former Engineer-in-Chief, recall how in a few hectic weeks in 1942 they supplied an alternative 12-channel telephony route from the UK mainland to Londonderry using frequency modulation (FM) to multi-channel links. It was the first ever application of its kind and has since proved one of the most important turning points in the history of telecommunications.

IT BECAME obvious during 1942 that urgent operational communications were needed for the North-West Approaches and in particular an alternative to the existing telephony routes from Great Britain to Northern Ireland. As a result a medley of co-axial, 12-channel carrier, VHF radio, undersea cable systems on the route Colwyn Bay–Holyhead–Douglas–Port Erin–Donaghadee was plotted and provision began.

Two of us (AHM and JKSJ) were involved in the overall operational plan wih JKSJ having the specific job of planning the building of a 12-channel VHF (60/70 MHZ) radio link between Holyhead and the then new radio station at Creg-ny-Baa near Douglas.

No particular difficulties, apart from the common wartime problems of blitz, blackout, rationing and shortages of plant, were foreseen although the long radio path distance of 65 miles and severely limited transmitter power, 10 watts at best, meant that performance margins scarcely existed. The then standard radio equipment, using amplitude modulation (AM) was installed. Frequency modulation (FM) had at that time been applied experimentally only in the United States and there, only to single channel broadcasting and police mobile radio systems. Digital technology was only just being invented.

Trouble occurred on through-system commissioning. Circuits were intermittently, but unacceptably, noisy and service could not be guaranteed. It was obvious that the radio signals from Holyhead, arriving at Creg-ny-Baa were being interfered with. But how and from where?

It being wartime many possibilities had to be considered. Eventually JKSJ found the cause – mundane, unexciting, but infuriatingly difficult to locate and resolve. It proved to be radio-frequency noise generated by complex high voltage discharges from insulators on the main, long overhead 11kv power line feeding the radio station itself.

The hunt was all the more difficult because the insulators were quiet in the rain – contrary to normal practice – but sparked over in transitions from "rain" to "dry" (and reverse) as sea-spray salt deposits grew and jostled against each other in the wind. The problem seemed insoluble to all those concerned.

While this pot of trouble was brewing, JHHM, totally unaware of the problem, was working with a team evacuated from Dollis Hill in the relative calm of a development laboratory at Castleton, near Cardiff. The work there included looking into any possible relevance of the then new technology of FM to Post Office radio communications.

In June 1942 the team succeeded in demonstrating to visitors from Headquarters in London the successful development of a useable single channel FM radio link for telephony with much greater quality and lower noise than its AM counterparts. Pride in success evaporated when the "Director" (AHM) cut short any celebrations: "I am not interested in a one-channel link. I want a 12-channel link. I want one that gives at least twelve db improvement in noise compared with present AM systems. And I want it in service in three weeks."

The challenge was issued. Starting from scratch, a complete main and standby 12-channel radio system using FM was designed, developed, tested in the laboratory at Castleton and shipped to Holyhead and Douglas in under three weeks. Miraculously the link worked within hours of being powered. It gave its planned 15db improvement with the local insulator-spark-generated noise sinking to acceptable levels. Thus AHM's target of "in service in three weeks" was met, urgent operational service was provided and a world first achieved – a notable feat, indeed.

After the success of Holyhead–Douglas came, within six months, a standard multi-channel radio link "pack" for transportable use, manufactured in quantity wholly by the Post Office. These were used for the fast provision and restoration of war-needed routes. Later they were developed to bear 24-channels and manufactured in quantity by Industry. They formed the basis not only of communications in the Highlands and Islands of Scotland but also a multi-million pound export business.

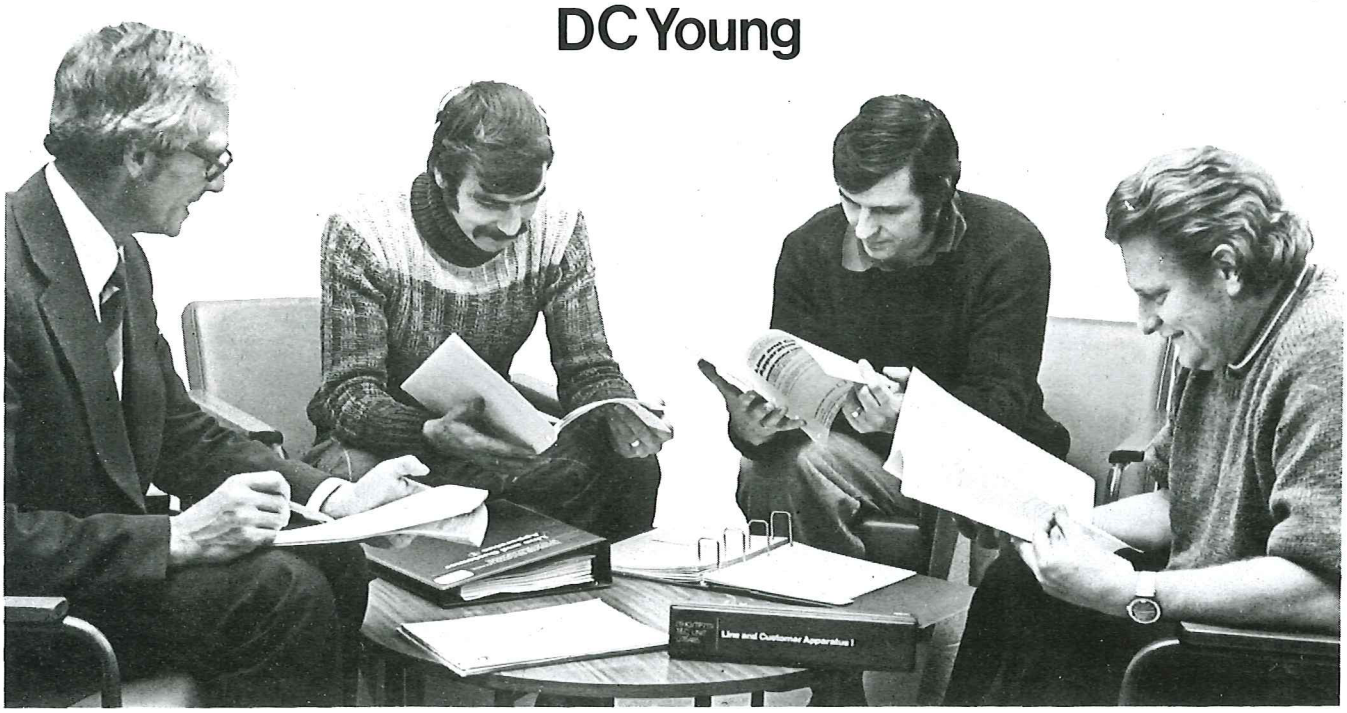
They provided – and many still do – country-wide communications in, for example, the developing nations of Africa, the Far-East and the Caribbean. From this, the jump of FM based technology into microwave and space systems bearing not twelve, but thousands of telephony channels, seemed an easy and natural step forward.

But it is the radio station at Creg-ny-Baa which stands as the landmark of the first commercial FM multi-channel radio system, born in excitement out of engineering foresight and imperative service demand.

PO Telecommunications Journal. Winter 1978/79

Package deal for students

DC Young



Assistant Executive Engineer on PBX maintenance, John Baker of LTR's Bromley Area Telephone Service Centre (left), enjoys an informal tutorial with (left to right) Michael Holmes, a maintenance faultsman joiner and Technicians John Martin and Alan Martin. All have been with the Post Office for several years but are aiming to improve their promotion chances with new qualifications.

THE POST OFFICE has a long history of staff development through planned training programmes many of which take the form of college attendances (see Telecommunications Journal, Autumn 1978). But for students unable for one reason or another to attend college classes, there is another avenue open – the correspondence course.

First available before 1912 when the Post Office took over the National Telephone Company, correspondence courses in technical subjects have, apart from during the war years, been a regular feature of Post Office Telecommunications training programmes since 1931. In that period thousands of stay-at-home students have been able to obtain the important qualifications to develop their careers.

Since 1945 a staff of full-time authors, editors and part time tutors have catered for 2,500 students a year in subjects ranging from practical mathematics, engineering science and elementary telecommunications to advanced switching principles and telephony. In addition to the courses, Post Office authors write and publish a large number of educational pamphlets which supplement the correspondence courses and also provide relevant technical education on selected topics.

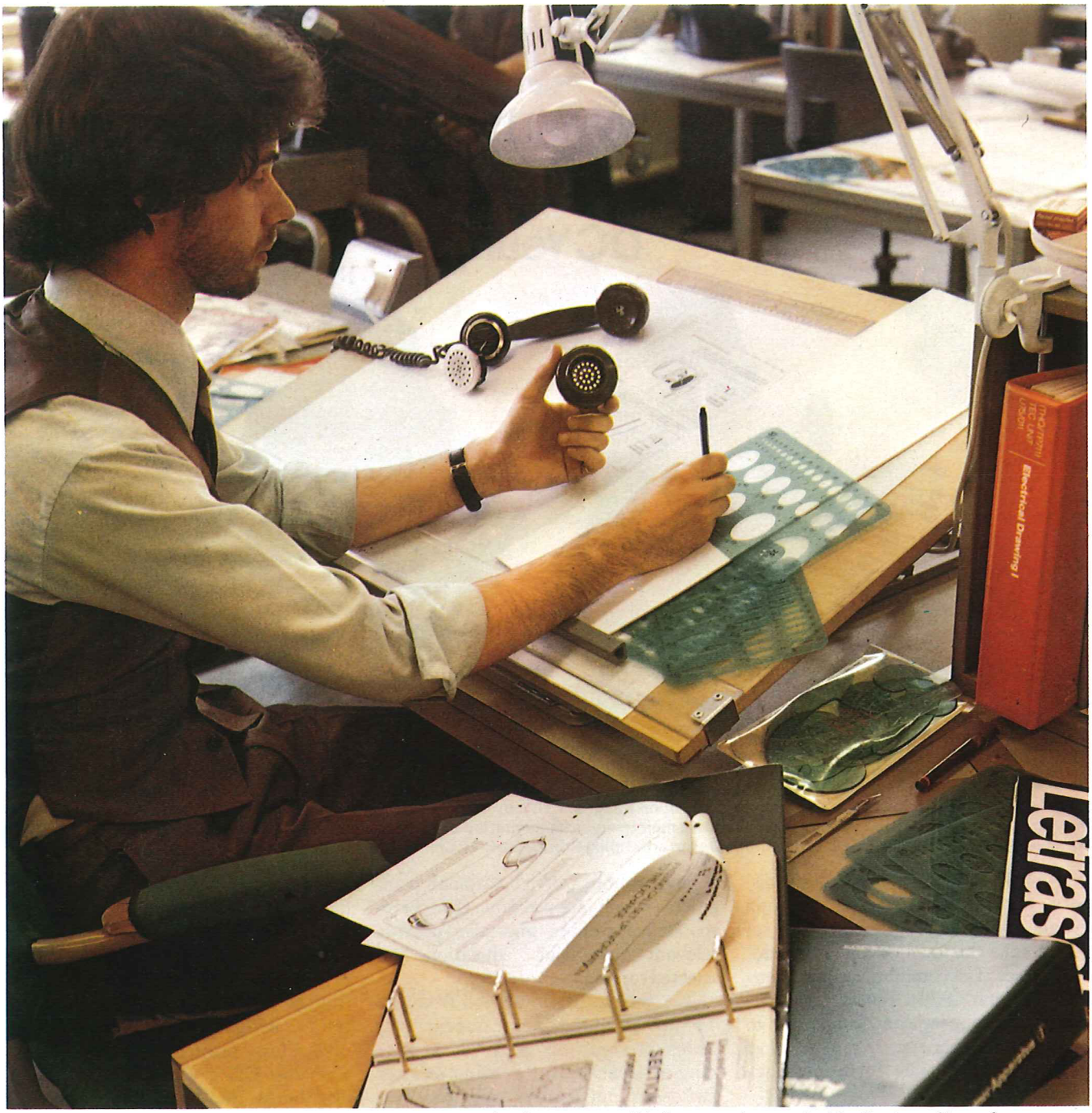
Now, following stimulation from the Technician Education Council (TEC) which was set up in 1973, a wide ranging appraisal of existing services has been undertaken and resulting from that a new External Student Scheme has been developed. This is based on the Packaged Learning Course technique which means providing all the learning material necessary to pass a particular course and packing it into an attractive binder.

The Scheme, demonstrated last Autumn at the Internavex Exhibition at Wembley Conference Centre, incorporates much student participation and "situation" audio cassette tapes are being used to provide the vital human touch – highly important to the distant student. Experimental cartoon drawings have been included to help introduce technical subject matter in easy stages, and along with the well presented text, there are instructions on use and self-assessed questions enabling the home student to monitor his own progress.

The Scheme however is much more than a collection of learning packages. It also boasts an experienced, well-trained team of authors, editors, tutors, invigilators, training officers, illustrators, printers and distributors. The Post Office writes, publishes and distributes the "packages" and colleges taking part in the scheme tutor the students. As well as college tutors there is a substantial back-up facility in which the Post Office provides its own "Industrial" Tutors to cover the specialist units and to provide truly national coverage.

Post Office personnel, of course, have a great deal of practical experience in "distance learning" techniques and can offer the new scheme the expertise required in written communication together with the availability which can readily, and economically, be introduced in the field.

One of the new features of the scheme is the face-to-face tutorial. Post Office students may have up to 20 hours' absence from official duties to attend tutorials and home students



Chris Allen, a Technical Illustrator in Reprographics Services, has been responsible for preparing much of the Packaged Learning Course material. Here he concentrates on a telephone handset illustration.

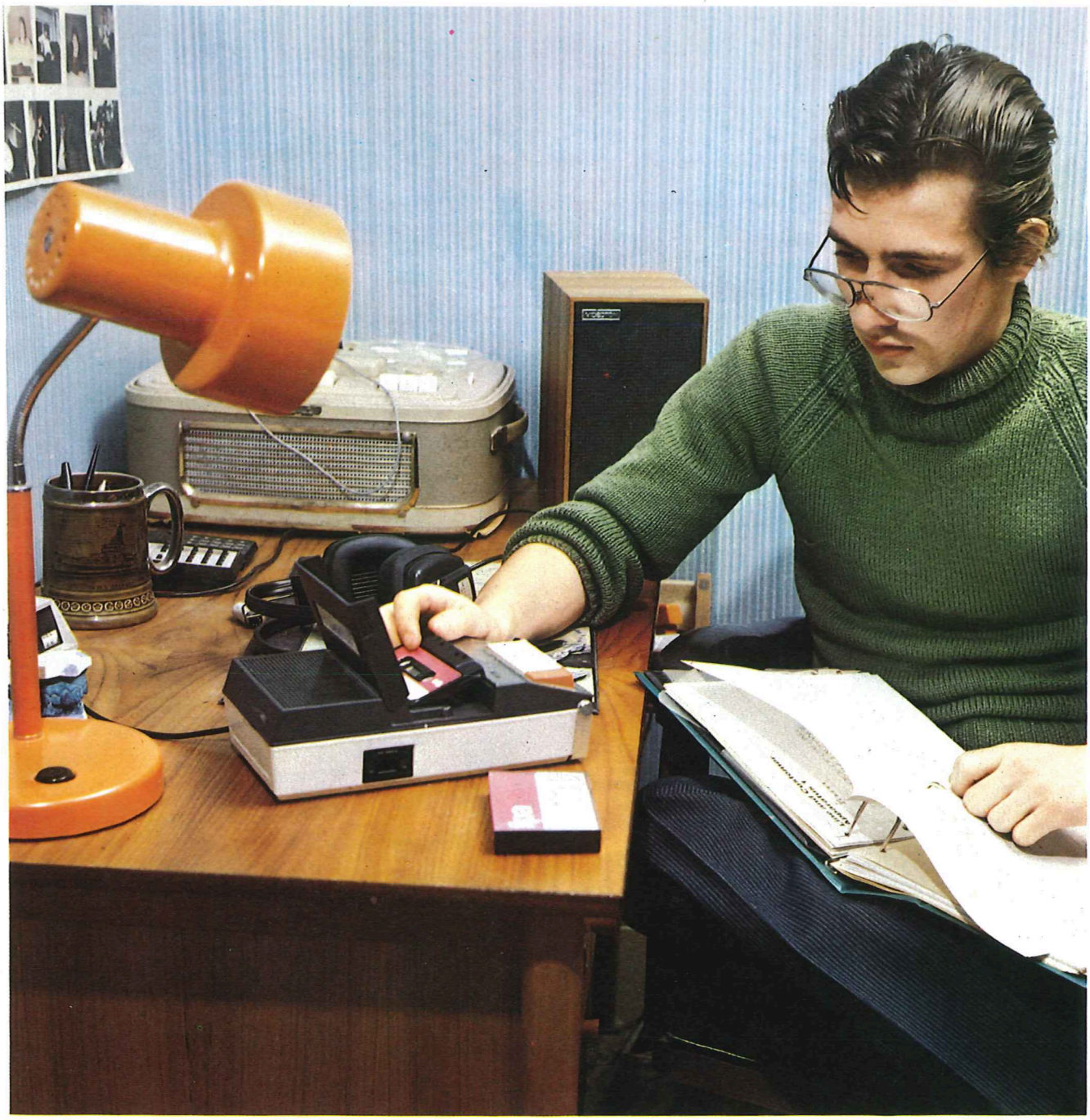
need not travel to college to sit examinations, but can attend a local Post Office centre with a staff invigilator.

Another important element is assessment of results. Students are internally assessed – 60 per cent weighting to in-course tests and 40 per cent to the end-of-course test. Students obtaining a pass or pass-with-merit mark are awarded "Record of Success" – subject to both internal and external scrutiny. These are valid currency for entry into the next level of the appropriate TEC subject and the student may then transfer to college attendance if he wishes and if a place is available for him to occupy.

Students already on Post Office City and Guilds correspondence courses normally receive 14 or 15 lessons throughout the year and end up with a sizeable amount of reading matter. Those in the new scheme will receive three packages containing about 50 segments or lessons. Each segment contains some 500 words and represents about an hour of reading. Segments usually cover teaching points and the principles as outlined by the specific learning objectives.

Harrogate, home of the Post Office Reprographic Service's long established printing and publishing centre for existing correspondence courses, also plays a big part in the new scheme. As well as printing, publishing and distributing Packaged Learning Courses, the centre collects all top copies of the new technical education enrolment cards and provides Vocational Training Division (VTD) with an on demand statistical service as well as the enrolment number for all Post Office tutored students.

To launch the scheme and provide necessary administrative support, handbooks have been produced for the Training Officers and one specifically designed for the authorised participating colleges. These contain the scheme objectives, schedules of procedures,



Robert Watts who joined the Post Office as a Technician in the THQ Circuit Laboratory last autumn uses a cassette recorder to tackle homework which is part of his Packaged Learning Course.

programmes, and the TEC Submission Document etc. Special stationery has also been designed and students will soon readily identify learning packages and associated material.

A series of seminars has already been conducted with staff such as Area Training Officers, who will be immediately involved in the field and the opportunity has also been taken to provide a much needed rationalisation of the technical education forms. Students enrolled under college or Post Office (Industrial) tutors will receive the same care, attention and expert advice.

The Post Office tutoring scheme will be internally assessed by VTD who will also deal with special cases and appeals as well as monitoring overall progress. In cases where colleges may insist on a minimum class number of, say, 13 for tutorials and where the Area requirement is much lower, students will be enrolled with Harrogate in the Post Office tutored scheme.

A pertinent question is whether the Post Office gets value for money. The economics of the new scheme indicate that it will. A much improved pass rate is envisaged coupled with the fact that Harrogate is operating on a marginal cost basis and the expected college fees should not be more than the charges made for normal evening class sessions.

In the meantime development work continues on Distance Learning Schemes and long term plans envisage not only computer applications but the use of the Post Office's own Prestel equipment for the stay-at-home student of the future.

Mr D. C. Young is an Executive Engineer in THQ Personnel Department's Vocational Training Division responsible for policy in engineering degree level studies and Technician Education Council line subjects.

The old way . . . A warehouseman at Gatwick checks off small, loose cargo using the laborious pencil and paper method.

LACES tie up at Gatwick

POST OFFICE computers, which for the last seven years have been taking the paperwork drudgery away from cargo checking staff at London Airport, are now being used to provide a similar service at Gatwick. The development is an extension of the successful London Airport Cargo Edp Scheme (LACES) to which Gatwick has been linked.

When LACES was introduced at Heathrow in 1971 it was the first scheme of its kind in the world and cut clearance time for imports to a matter of hours. It provides inventory control of all cargo arriving at Heathrow, calculates duty and revenue and the selection of goods and documents for Customs' inspection, produces the calculation of the agents' daily accounts with Customs and deals with the compilation of Customs' statistics. The first two are on-line processing and the others are dealt with in bulk once a day in what is called batch processing.

Instead of walking round a pile of crates and cartons ticking them off with a pencil stub on a manifest list, airport staff at Gatwick will key in details of anything from machinery to live lobsters on the typewriter-like keyboards of visual display units (VDUs). These will instantly send the details to the Post Office's National Data Processing Service computers at Harmondsworth computer centre three miles from Heathrow.

Additionally it will be possible to clear goods with Customs by computer even if those goods are at the other airport instead of either physically travelling up to check them or hiring an

The new way . . . Mrs Heather Dowling a Higher Executive Officer working on the LACES project oversees simulation tests at Gatwick.

agent at the other end to do so. Representatives of agents, airlines and shed operators at Gatwick have had courses in using the VDUs.

At Gatwick there are 12 VDUs linked to a controller which rations out their use of the computer but so rapidly that each seems to have immediate access to and response from it. This shared mode of working saves both money and individual lines. There will also be two "stand-alone" units which do not need controllers but have individual lines. There are 10 character printers to print out all various details.

Although Heathrow with its 200 VDUs and 64 character printers has a much larger installation, Gatwick's share of cargo operations is expected to grow considerably. One estimate is that it will eventually handle 450,000 tonnes of cargo a year.

Currently 200 separate organisations use LACES at Harmondsworth where two ICL 4/72 computers are on duty 24 hours a day, seven days a week one working, one used as standby. They are linked to the airport by Post Office Datel lines transmitting at 110 bits a second for the character printers and 2,400 bits a second for the VDUs.

LACES is operated on behalf of the users by NDPS which was asked to continue its services until after September 1980 when current contracts expire. LACES users have set up a steering body to consider air cargo processing facilities in the 1980s and NDPS is bidding for the competitive tender for the new systems.

Duct 16

A new era in duct technology

Into the 1980's with Duct 16

Hepworth are entering a new era with the introduction of the superior Duct 16, made possible by the development of a new clay-based material.

Duct 16 is lighter, easier to handle and more economical to transport.

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MISCELLANY

Prestel goes to Russia

Prestel, the Post Office viewdata system, has penetrated behind the Iron Curtain in a presentation to Soviet government officials in Russia, the 17th country to feature a demonstration of the system since its unveiling three years ago. The move is part of the vigorous sales efforts of the Post Office's international promotions unit set up last year to put Prestel on the world map.

Already computer programs have been exported to West Germany and the Netherlands and negotiations are well in hand for the sale of advanced software in follow-up deals. Arrangements for software sales to Hong Kong are also in hand and for the United States the Post Office is in the process of concluding an agreement with Insac Data Systems for launching a viewdata service in America during 1979.

With overseas interest growing swiftly, the Post Office is planning a global organisation that will enable Britain to capitalise on its viewdata invention. Under the plan a world-wide network of agents would be set up to promote and sell Prestel.

Prestel readily lends itself to other languages. For the Moscow presentation a number of demonstration pages were set up in the cyrillic characters of the Russian alphabet and Post Office Research Department is currently working on producing viewdata graphics for many other languages particularly Arabic, Greek, Hebrew and Katakana – phonetic Japanese.

Trunk calls up

Latest Post Office figures show that telephone users in Britain made 1,223 million trunk calls in the first five months of the current financial year. This was a 12.7 per cent increase on the corresponding period to 31 August 1977 amounting to 138 million calls.

More than 97 per cent of trunk calls made during the five month period were dialled direct by customers, using Subscriber Trunk Dialling (STD). The Post Office is currently investing about £250 million a year to cater for local and trunk calls.

DQ by computer

A three-month trial of the new computer-based system for Directory Enquiries (DQ) which stores details of directory entries on computer file, and can then be interrogated swiftly and accurately has gone on trial.

Every weekday more than a million requests for phone numbers are received at 260 DQ centres throughout Britain. Under the old system an operator needs to search through 60 volumes of directory records covering 20 feet of shelf space. The new system provides only a television screen and typewriter keyboard for operators to key in relevant details of name, town and, if necessary, a part of the customer's address. The computer then searches its records and displays the answer on the television screen.

The trial is being conducted at two centres – Leeds and Leatherhead – where operators have access to about half the national total of 15 million directory entries enabling them to answer between 80 and 85 per cent of enquiries without recourse to the old book system.

Meanwhile as directory entries continue to grow and become increasingly unmanageable the Post Office is introducing an interim scheme for operators by storing information on microfiche. Each fiche contains the equivalent of 68 pages of a directory and operators use a special viewer to read the tiny images.

More autotelex

Britain's telex links with New Delhi, Calcutta, the Seychelles, Mauritius, Tonga and the Yemen Arab Republic have gone automatic, making a total of 120 countries which Britain's telex users can now dial direct. Monthly telex calls to these countries range from 30 to Tonga to 2,500 to Mauritius.

Optical video link

The first ever transatlantic video link to originate and terminate over optical fibres – hair-thin strands of glass fibre along which telephone conversations, television pictures and computer data can be carried as pulses of light – was used at a special meeting involving Post Office Chairman Sir William Barlow and the Chairman of Bell Canada, Mr A Jean de Grandpré.

Taking place exactly 77 years after Marconi sent the first telegraph message across the Atlantic, this modern transmission linked the Post Office's Confravision studio in London with a Bell Canada studio in Toronto and provided confravision with its first colour pictures.

The Post Office and British industry have now developed optical fibre systems to the extent that they could be installed and working in the UK telephone network by 1980.

New Directors

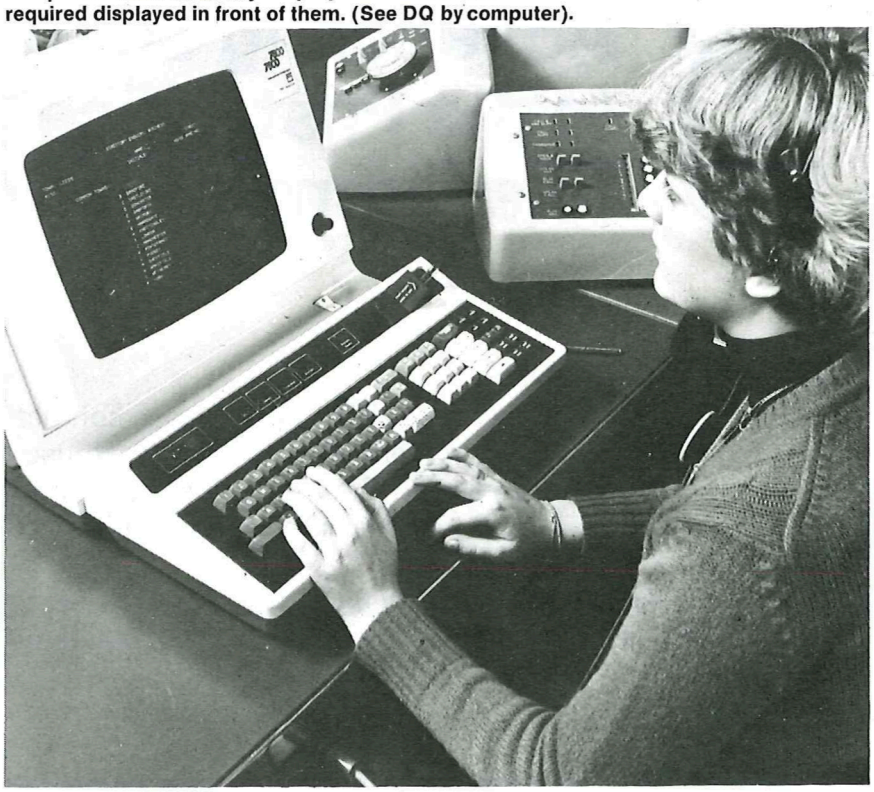
Two new Telecommunications Regional Directors have been appointed by the Post Office. Mr Geoff Brooks (50), previously Director of Special Studies in Telecommunications Headquarters (THQ), became Director, North Eastern Region on the retirement of Mr Norman Gandon in January and Mr Brian Cross (45), Head of Data Systems Planning in THQ, is to be appointed Director, South Eastern Region in March on the retirement of Mr Jerry Barker.

Go ahead for PSS

After 18 months of the Experimental Packet Switched Service (EPSS) the Post Office has decided to go ahead with its permanent Packet Switched data Service (PSS). Due to begin working in about a year's time, it is part of the Post Office's massive £1,000 million a year investment programme providing for growth and development of future services.

PSS will give UK users access to two inter-

After keying in customer information operators taking part in the Post Office's computer based directory enquiry trial see the number required displayed in front of them. (See DQ by computer).



national data links, IPSS – International Packet Switched Service across the Atlantic and the EEC Euronet system. At the start it will be based on nine packet switch exchanges sited in London, Birmingham, Bristol, Cambridge, Edinburgh, Glasgow, Leeds, Manchester and Reading interconnected by 48 KHZ circuits operating at 48 Kbits/s.

IPSS between Britain and the USA was successfully introduced in December giving users in the UK access to a wide range of computing services and computer-based information in America, and also meaning that customers' terminals no longer need to be compatible with those of the computer being accessed. This new service is available in both directions and is planned for extension to other countries including Canada, Japan and Eire.

Contracts

Plessey Telecommunications Ltd – £2 million for Type 20 Datel modems for national and international use in transferring data via telephone lines between computer terminals and their central processing units. The order, which includes an option for an additional £800,000 worth of equipment, is for delivery in 1979.

EMI Sound and Vision Equipment – £2.75 million for the supply of telephone dials, manufactured in South Wales, for delivery over a 12-month period beginning in April 1979.

Pye TMC Ltd – £2.2 million for two Electronic Regenerators used in network performance enhancement to receive, temporarily store, regenerate and repeat to line loop-disconnect impulses at 10 pulses per second.

Plessey Communications and Data Systems – £890,000 for two new telephone designs, the Mickey Mouse and Compact styles. Availability of the Mickey Mouse telephone coincides with the 50th anniversary of the Walt Disney character. The compact is the first new residential telephone design for some years.

Rally by phone

The Post Office recorded information service provided coverage of the 1978 Lombard-RAC International Rally from 43 centres throughout the country – fourteen more than in 1977, when 340,000 calls were received.

Regular reports, updated every few hours, on the progress of the 1,900 mile rally were the main feature and a detailed results list and interview with the winning team completed the service.

Quality of Service

In the second quarter of the current financial year quality of service statistics showed a 1.6 per cent improvement over the same period last year. More than 63 per cent of inland calls dialled by customers were successfully connected, 82 per cent of inland calls to the operator service were answered within 15 seconds and only 1.5 per cent of local customer-dialled calls and 3.8 per cent of STD calls failed due to the Post Office.

Fault clearance rates showed a decline and there was also a higher rate of failure on International Direct Dialled (IDD) calls, much of which was attributable to the effects of the Post Office Engineering Union industrial action during the period.

IDD links up

International Direct Dialling (IDD) facilities have been extended to Costa Rica, Fiji, Turkey, Macao, El Salvador, Guatemala and The Dominican Republic. The countries available to UK telephone customers dialling direct now stands at 83.

Call transfer facility

A new business communications service which allows UK phone users to telephone selected overseas firms by simply dialling a London number has gone on trial. An international call transfer facility – calls are automatically re-directed over the international telephone network at no extra cost to the caller – the service has been launched in cooperation with Service 800 SA, a Swiss company which is responsible for its marketing.

The two major attractions of the new service are that overseas businesses can have a British phone number in Britain

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without on-the-spot representation and UK customers' can contact foreign firms without paying for an international call.

First customers include an international hotel group with a central reservation office in Brussels, an investment banker in New York and a stockbroker in Geneva.

Prizes for art

A national 'pictorial' competition for young people in the UK is currently being run by the Post Office in which entrants must use their imagination to portray telecommunications today and in the future. Some 180 prizes can be won – totalling £6,750 – and the best entries will go forward to an international competition marking the World Telecommunications Exhibition, TELECOM 79 in Geneva next September.

The theme is "Telecommunications in day-to-day life and in the future" to be expressed visually in photographs, drawings, paintings or other illustrations. All entries to be received by 1 March, 1979.

Profits up

Half yearly figures issued by the Post Office showed a profit of £170.2 million, an increase of £10.5 millions over the same period last year. Post Office Chairman Sir William Barlow commented that "continued stable prices and a vigorous drive for increased business enabled the Post Office to achieve results which show that the Corporation is meeting financial targets set by Government".

On the slopes

The traditional telephone information service on Scottish ski-ing conditions has been available again this winter. Run by the Scottish Telecommunications Board in conjunction with Glasgow's Weather Centre the service will continue until the end of April.

Since the service first became available in 1971, usage has regularly increased – and nearly 160,000 calls were registered last season – the highest ever. Available on Subscriber Trunk Dialling (STD) the number to ring is 031-246 8041.

PROMOTION IS THE GOAL

Top Isthmian League soccer club Oxford City broke fresh ground earlier this season when they took the field wearing new shirts with the word "Telecomms" displayed in red on the club's famous dark blue and white hooped shirts.

The move is part of a £1,500 joint promotional package provided by Eastern Telecommunications Region in return for considerable exclusive promotional rights for the current season. Naturally, the scheme was launched by a guest appearance from Buzby and balloons and other promotional material were handed out to spectators.

Approval for the advertisement on the shirts was given by the Football Association and Oxford are one of only a few clubs in the country at present taking advantage of the FA's new code of regulations about advertising. Part of the promotion allows Post Office Telecommunications a wide range of exclusive promotional and advertising facilities throughout the country.

Programme covers for the whole season are carrying a full-page advertisement for telephone sales and service; the club's 300,000 lottery tickets are displaying the Buzby motif; there is a tie-up between the club's junior supporters section and the Post Office Buzby club with Buzby tee shirts available and the club's coach signs carry the Buzby motif.

In addition more than 100 feet of free advertising space around the ground has been allocated to the Post Office, the club's spacious supporters club premises are available for Post Office staff functions and advertising jingles are being broadcast over the loudspeaker system on match days. The club and players are also co-operating in joint promotional events with Buzby and the Post Office.

TELEPHONE EXCHANGE MANAGEMENT

A vital seminar for Switchboard Supervisors, Chief Operators and Office Service Managers

LONDON **GLOUCESTER HOTEL** **MARCH 8th 1979**

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- Singled out by MANAGEMENT COURSES INDEX as a highspot of last season: . . . "most helpful sessions on day to day running of the switchboard, staff handling and internal telephone directories".
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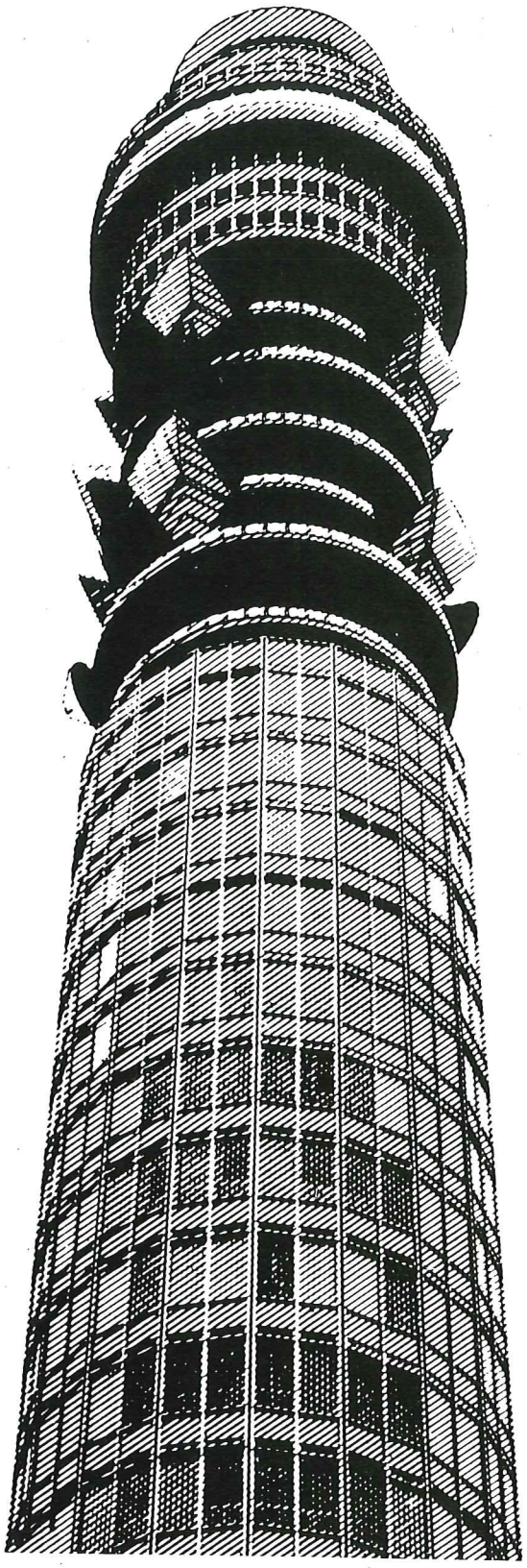
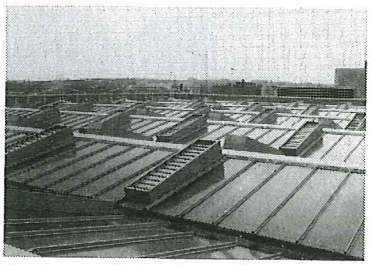
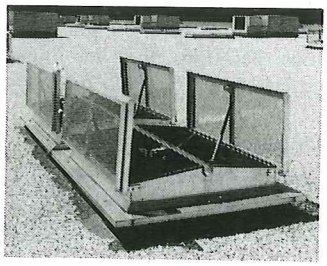


'Only the best' was the directive. So Crittall's won the stamp of approval for design and installation of curtain walling at the P.O. Tower. And Crittall's are readily available to discuss similar projects. To augment vast experience and impressive resources, Crittall's operate a national fixing service.

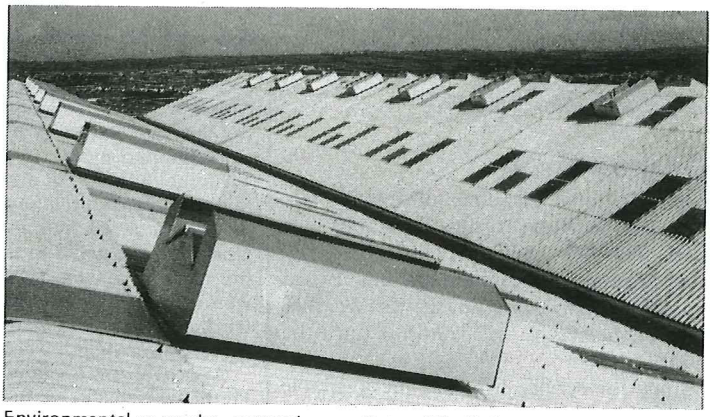
Clearly, for curtain walling, patent glazing, ventilation equipment and roof lights . . . . . Crittall's come first.

Seen below are examples of Crittall's comprehensive product range.





Smoke Ventilation Extraction equipment.
Above: H.A.L. type. Right: 'Firelite' type



Environmental or smoke–extraction ventilator, 'Firefly' type.

Canning Town Sorting Office, London; patent glazing and curtain walling by Crittall Construction.

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INDEX TO VOLUME 30 – Spring 1978 to Winter 1978/79

ALPHABETICAL INDEX

Title	*Author*	*Issue*	*Pages*
Abroad with Prestel	R. D. Bright	Summer	7–9
Add-on units spread the word	G. Routhorn & S. Kersley	Winter	14–15
. . . and prize competitions, too	R. Christy	Winter	27
An era ends	—	Winter	19
Armchair focus on world of sport	D. A. Golesworthy	Autumn	21–23
As simple as ABC	J. Valentine	Autumn	26–27
Behind the figures	R. H. Adams	Winter	22–24
Big advance for small PABX	D. F. Griffiths	Spring	26–28
Blasted rock makes way for cable	R. H. Lewis	Summer	20–22
Cable links across the desert	J. Boag & G. C. C. Higgs	Winter	11–13
Change for public telephones	B. Ralph	Winter	5–7
Communications for all at sea	P. Mitchell	Spring	21–23
Computer measures for undersea cable	P. J. Clark & C. Ball	Autumn	4–6
The digital way ahead	G. H. Bennett	Spring	18–20
Down to earth measures for space communications	R. G. Blake	Winter	8–10
Forward step for facsimile	A. H. Robinson & A. T. Bence	Summer	10–11
A future for telegrams	T. Finucane	Summer	15
Getting to grips with undersea cables	J. E. H. Cosier	Spring	7–9
Helping staff from overseas	R. N. Fletcher & R. Parker	Spring	10–11
Historical home for management training	J. H. Ollerton	Summer	12–14
Holding the purse strings	K. Nash	Autumn	10–11
How women make the grade	J. Sweeney	Summer	28–29
The Hull connection	D. A. Whitbread	Winter	16–18
In a man's world	G. Cox	Winter	20–21
In the best of health	Dr P. Gilbert	Autumn	7–9
Island outpost	B. W. Fielding	Autumn	16–17
It's radio by phone . . .	B. W. Fielding	Winter	25–26
Keeping a legal eye open	C. L. Morrow	Autumn	18–20
Keeping in the picture	J. McDermid	Summer	26–27
LACES tie-up at Gatwick	—	Winter	32–33
Low cost chips bring digital advance	P. A. Mitchell	Summer	18–19
Madley – birth of an earth station	M. Flack	Summer	4–6
Many happy returns	F. G. Phillips	Autumn	32
Memories on Man	J. K. S. Jowett, Sir A. H. Mumford & Prof J. H. H. Merriman	Winter	28
Mondial House – gateway to the world	E. A. Thomas	Spring	4–6
On course with technical training	N. Fox & G. C. King	Autumn	12–14
Operation blizzard	—	Spring	16–17
Package deal for students	D. C. Young	Winter	29–31
The phone-in phenomenon	P. G. Archer & B. Egglestone	Summer	16–17
Prestel – the world's first viewdata service	—	Spring	1
Private agents go on trial	D. C. Bowen	Spring	2–3
Public show for packet switching	—	Summer	1
Running a fleet	P. Gascoigne	Spring	24–25
Safety matters in the office	R. G. Vance & J. Ferris	Autumn	28–29
Seaside service for sailors	G. A. Evans & B. Vaughan	Summer	2–3
Space for doubling satellite capacity	J. E. Purdy	Summer	30–33
Space for links with Europe	—	Autumn	1
Stronger links for British Steel	D. Richardson & E. H. Ridgway	Spring	29–31
Switching links for the IBA	D. Newberry	Winter	2–4
Take-off for six-year project	G. R. Lee & A. B. Peterson	Summer	23–25
The ten year target	D. Maul	Autumn	2–3
Towards a new generation	—	Autumn	15
TXE4A – The cost cutting space saver	D. H. Vogan	Spring	12–14
The world of autotelex – by computer	—	Winter	1
The year in figures	—	Autumn	25
Year of record growth	—	Autumn	24

GROUP INDEX

Subject	*Issue*	*Pages*
General		
A future for telegrams	Summer	15
Helping staff from overseas	Spring	10–11
Historical home for management training	Summer	12–14
Holding the purse strings	Autumn	10–11
How women make the grade	Summer	28–29
In a man's world	Winter	20–21
In the best of health	Autumn	7–9
Island outpost	Autumn	16–17
Keeping a legal eye open	Autumn	18–20
Keeping in the picture	Summer	26–27
Many happy returns	Autumn	32
On course with technical training	Autumn	12–14
Operation blizzard	Spring	16–17
Package deal for students	Winter	29–31
Private agents go on trial	Spring	2–3
Running a fleet	Spring	24–25
Safety matters in the office	Autumn	28–29
The ten year target	Autumn	2–3
The year in figures	Autumn	25
Year of record growth	Autumn	24
Cables		
An era ends	Winter	19
Blasted rock makes way for cable	Summer	20–22
Cable links across the desert	Winter	11–13
Getting to grips with undersea cables	Spring	7–9
Computers		
Computer measures for undersea cable	Autumn	4–6
LACES tie-up at Gatwick	Winter	32–33
Data Transmission		
The digital way ahead	Spring	18–20
Low cost chips bring digital advance	Summer	18–19
Public show for packet switching	Summer	1
Radio and Television		
. . . and prize competitions, too	Winter	27
Communications for all at sea	Spring	21–23
It's radio by phone . . .	Winter	25–26
Memories on Man	Winter	28
Switching links for the IBA	Winter	2–4
Satellite Communications		
Armchair focus on world of sport	Autumn	21–23
Down to earth measures for space communication	Winter	8–10
Madley – birth of an earth station	Summer	4–6
Space for doubling satellite capacity	Summer	30–33
Space for links with Europe	Autumn	1
Towards a new generation	Autumn	15
Telephones and Telex		
Abroad with Prestel	Summer	7–9
Add-on units spread the word	Winter	14–15
As simple as ABC	Autumn	26–27
Behind the figures	Winter	22–24
Big advance for small PABX	Spring	26–28
Change for public telephones	Winter	5–7
Forward step for facsimile	Summer	10–11
The Hull connection	Winter	16–18
Mondial House – gateway to the world	Spring	4–6
The phone-in phenomenon	Summer	16–17
Prestel – the world's first viewdata service	Spring	1
Seaside service for sailors	Summer	2–3
Stronger links for British Steel	Spring	29–31
Take-off for six-year project	Summer	23–25
TXE4A – The cost cutting space saver	Spring	12–14
The world of autotelex – by computer	Winter	1

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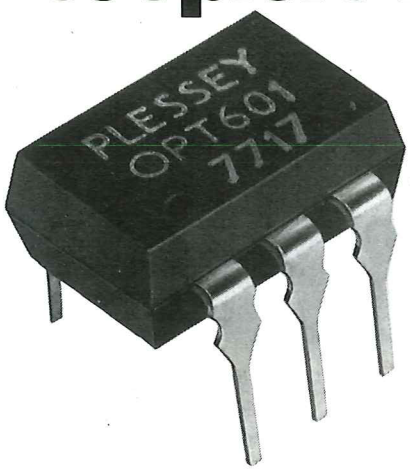

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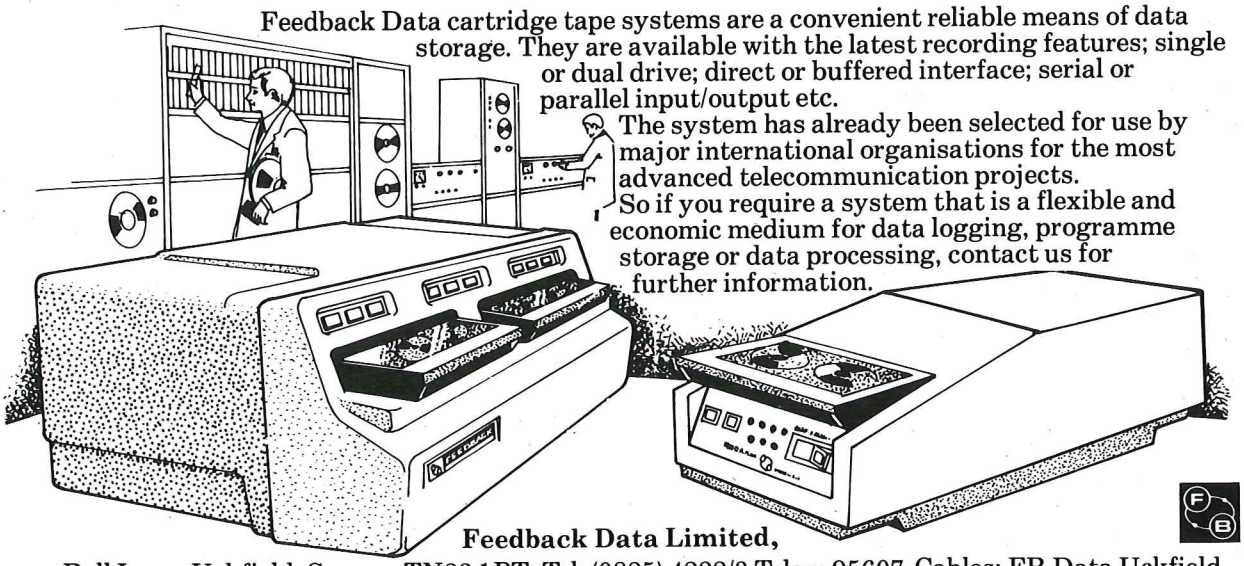

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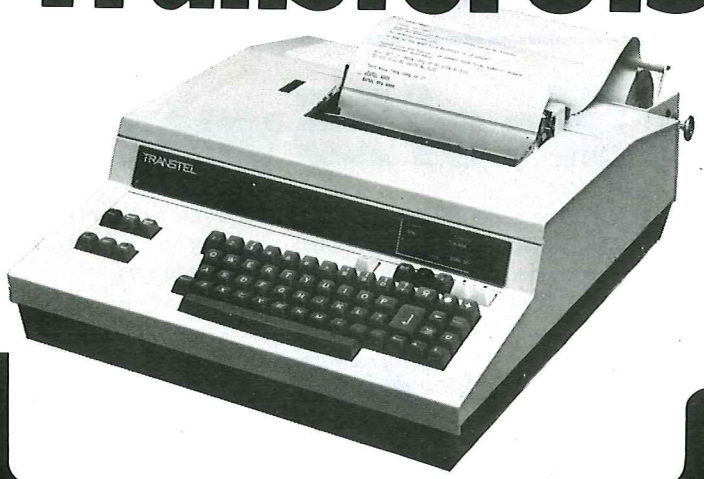

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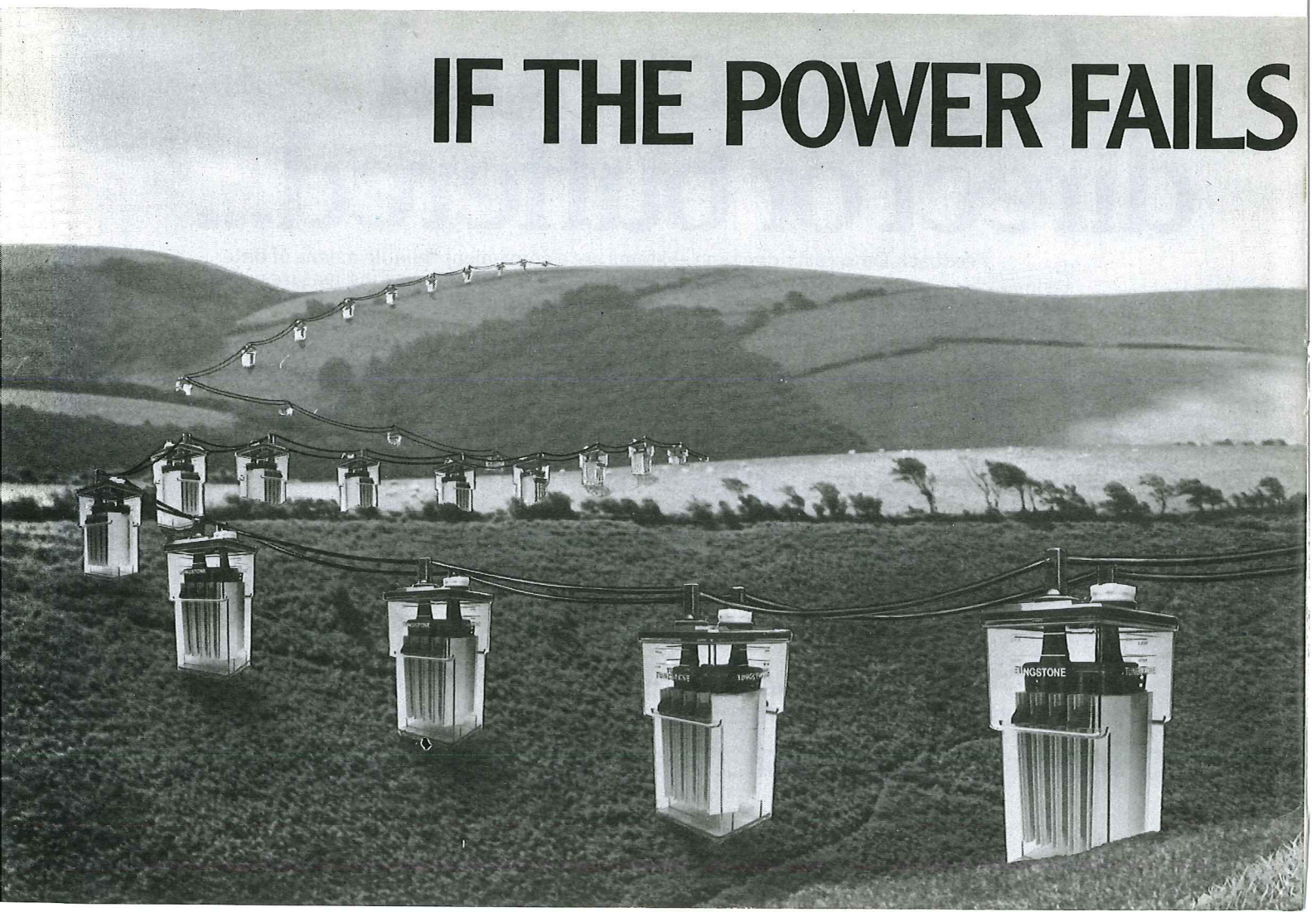

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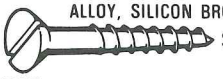


SLOTTED AND POZIDRIV

HEADS	RANGE
COUNTERSUNK	4 SWG × ½" TO 12 SWG × 3"
RAISED COUNTERSUNK	4 SWG × ¾" TO 10 SWG × 2"
ROUND	6 SWG × ¾" TO 12 SWG × 2½"

SELF-TAPPING SCREWS

18/8 (A2) STAINLESS

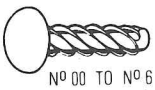
TYPE AB
SLOTTED AND POZIDRIV

HEADS	RANGE	
COUNTERSUNK	Nº 4 TO Nº 10	⅜" TO 1¼"
RAISED COUNTERSUNK	Nº 4 TO Nº 10	⅜" TO 1½"
PAN	Nº 4 TO Nº 12	¼" TO 1½"
MUSHROOM	Nº 4 TO Nº 8	¼" TO ½"

TYPE B
SLOTTED

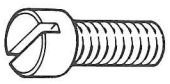
HEADS	RANGE	
COUNTERSUNK	Nº 6 TO Nº 10	¼" TO 1¼"
PAN	Nº 2 TO Nº 10	¼" TO 1¼"

HAMMER DRIVE SCREWS TYPE U



Nº 00 TO Nº 6 ⅛" TO ⅜"

MACHINE SCREWS



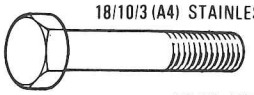
18/8 (A2) AND 18/10/3 (A4) STAINLESS

SLOTTED

HEADS	RANGE	
COUNTERSUNK	M3 TO M10	6mm TO 50mm
	6BA TO 2BA	3/16" TO 1½"
	BSW 3/16" TO ⅜"	¼" TO 2"
ROUND	6BA TO 2BA	¼" TO 1"
	BSW 3/16" TO ¼"	¼" TO 2"
CHEESE	M3 TO M10	5mm TO 50mm
	6BA TO 2BA	3/16" TO ¾"
PAN	M2 TO M10	5mm TO 50mm

BOLTS

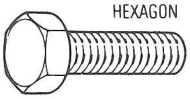
18/8 (A2) AND 18/10/3 (A4) STAINLESS



HEXAGON	M5 TO M24	30mm TO 150mm
	BSW ¼" TO 1"	¾" TO 6"
	BSF ¼" TO ⅝"	¾" TO 4"
	UNC ¼" TO 1"	1¼" TO 6"
	UNF ¼" TO ⅝"	1¼" TO 4"

SETSCREWS

18/8 (A2) STAINLESS



HEXAGON	M5 TO M24	8mm TO 100mm
	BSW 3/16" TO 1"	⅜" TO 4"
	BSF ¼" TO 1"	½" TO 4"
	UNC ¼" TO 1"	½" TO 4"
	UNF ¼" TO ⅝"	½" TO 4"

18/10/3 (A4) STAINLESS

HEXAGON	M2·5 TO M4	6mm TO 35mm
	8BA TO 0BA	3/16" TO 2"

NUTS

18/8 (A2) STAINLESS

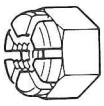
FULL

M1·6 TO M36
BSW ⅛" TO 1½"
BSF 3/16" TO 1"
UNC 4-40 TO 1½"
UNF 4-40 TO 1"

LOCK

M1·6 TO M24
BSW 3/16" TO 1"
BSF ¼" TO ¾"
UNC 4-40 TO ¾"
UNF 4-40 TO ¾"

CASTLE



M4 TO M36
BSW ¼" TO 1½"
BSF ¼" TO 1"
UNC 4 TO 12
UNF 4 TO 12

SLOTTED

M4 TO M36
BSW ¼" TO 1½"
BSF ¼" TO 1"
UNC 4 TO 12
UNF 4 TO 12

ALL METAL SELF-LOCKING (AEROTIGHT)

M3 TO M16
6BA TO 2BA
BSW 3/16" TO ½"
BSF ¼" TO ⅜"
UNC ¼" TO 5/16"

NYLON INSERT

M3 TO M24
UNC ¼" TO ¾"

WING

M5 TO M12
BSW 3/16" TO ⅜"

DOME

M5 TO M12
BSW 3/16" TO ⅜"

WASHERS

PRESSED
18/8 (A2) AND 18/10/3 (A4) STAINLESS

FORMS A AND B TO BS 4320
M2·5 TO M30
TO BS 3410
10BA TO 0BA
BSW 3/16" TO 1"

SPRING
SINGLE COIL, RECTANGULAR
18/8 (A2)

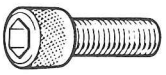
M2·5 TO M12
8BA TO 0BA
BSW ⅛" TO 1"

SHAKEPROOF
INTERNAL TEETH
18/8 (A2) STAINLESS

M2·5 TO M12
BSW 3/16" TO 1"

SOCKET SCREWS

18/8 (A2) STAINLESS



HEADS		RANGE	
CAP		M3 TO M12	6mm TO 50mm
		6BA TO 0BA	¼" TO 1½"
		BSW 3/16" TO ½"	⅜" TO 2"
		BSF ¼" TO ⅜"	½" TO 1¼"
		UNC ¼" TO ⅜"	½" TO 2"
		UNF Nº 10 TO ¼"	⅜" TO 1"
COUNTERSUNK		ON APPLICATION	
SETSCREWS	CUP	M3 TO M12	3mm TO 25mm
		6BA TO 2BA	3/16" TO ½"
		BSW 3/16" TO ⅜"	¼" TO ¾"
		UNC ¼"	¼" TO ⅜"
	W POINT	M10 TO M24	10mm TO 60mm
	BUTTON	ON APPLICATION	
		1936 SERIES ALSO AVAILABLE; SIZES ON APPLICATION	

STUDDING

18/8 (A2) AND 18/10/3 (A4) STAINLESS

M3 TO M24	1 METRE LENGTHS
6BA TO 0BA	3' LENGTHS
BSW 3/16" TO 1"	3' LENGTHS
UNC ¼" TO 1"	3' LENGTHS

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